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Electrical World

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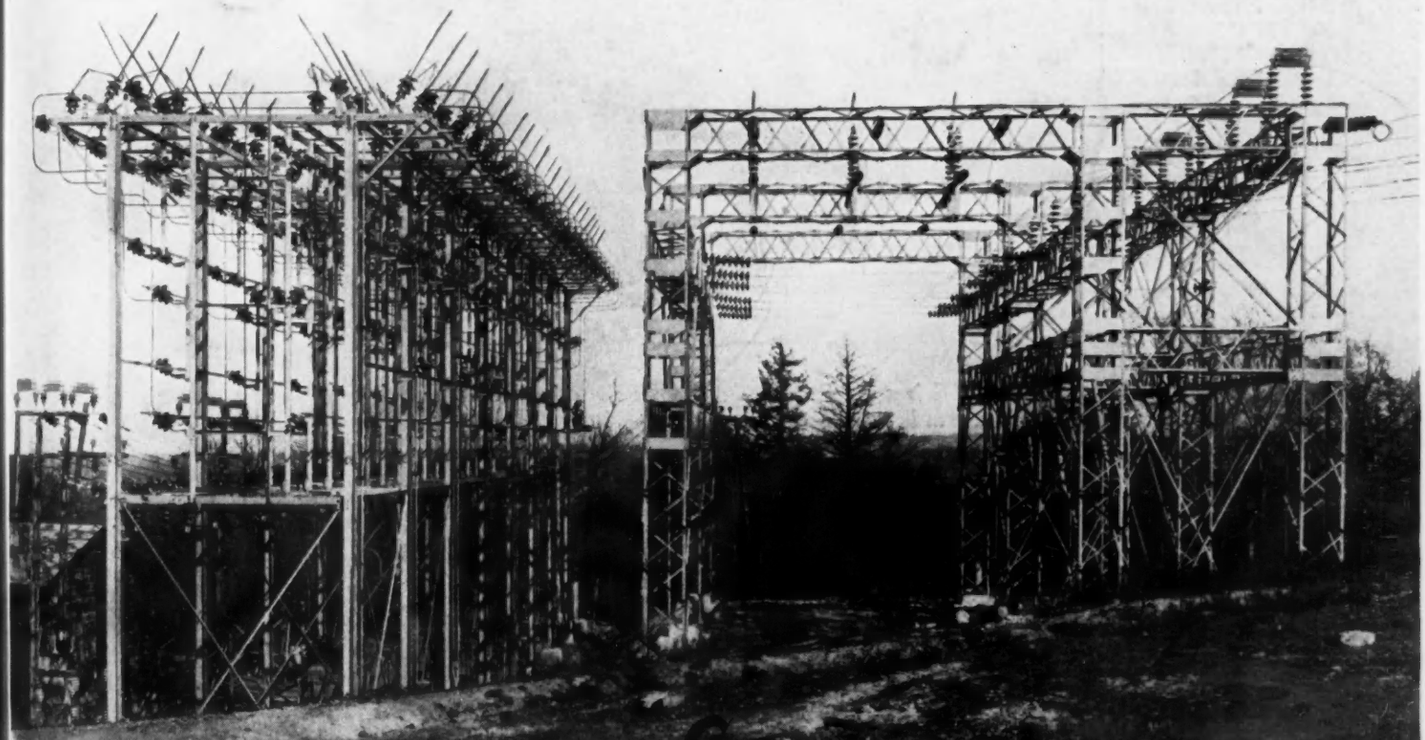

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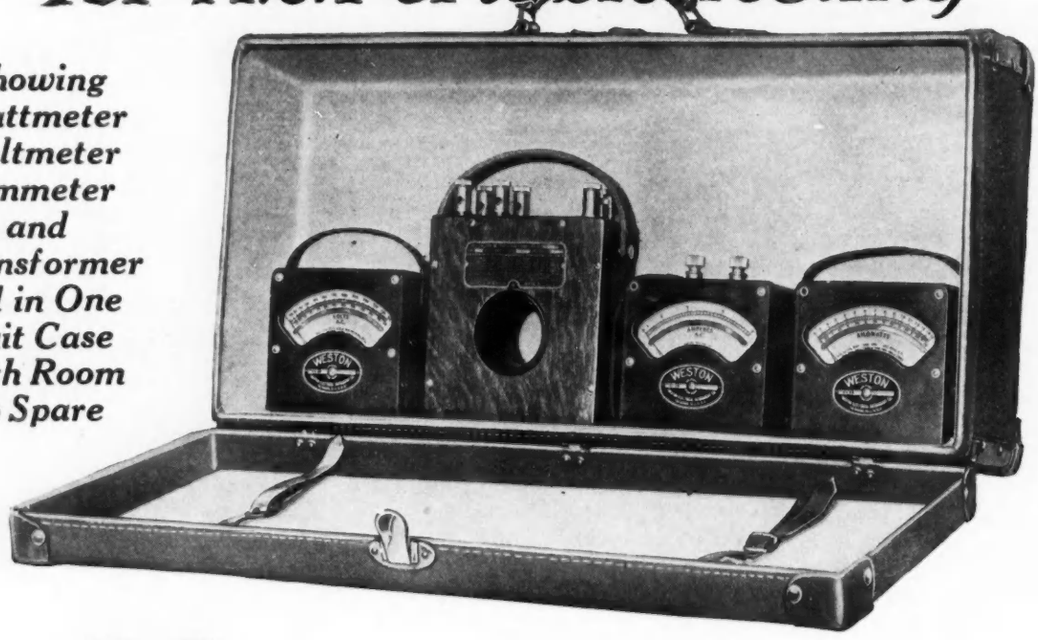

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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The Superpower Conference of the Public Ownership League

THE Public Ownership League of America held a public conference in Washington, D. C., on January 16 and 17. Superpower was the theme around which the conference was built, but even that magic word failed to draw an audience. At none of the sessions did the attendance, including speakers, officers, women and newspaper reporters, approach even a baker's dozen. The speakers were confronted with empty benches, and it was just as well, because none of them knew anything about superpower except superficially. When a national society holds a two-day convention and cannot muster an audience to listen to its program, something is wrong. Something was radically wrong with the Washington conference of the Public Ownership League of America, and it is a pity that the entire membership will not become aware of the fiasco. Certainly a great opportunity was missed. The Public Ownership League of America has criticised the electric light and power industry severely because it took up the subject of superpower and made superpower more than a word. Yet when the league had an opportunity to make some contribution to the subject of superpower it failed lamentably. Its objective turned out to be destructive instead of constructive, and it is well that the public, which does not quickly differentiate between the genuine and the spurious, gaged the conference at its proper value—worthless.

Widespread Interest in the Institute Election

THERE appears to be more than the usual interest in the forthcoming election of officers for the American Institute of Electrical Engineers, not only as regards the presidency but also concerning various other offices. More than one candidate has been proposed by petition, and there is lively discussion as to who will or should be elected. While it is not within the province of the ELECTRICAL WORLD to pick and choose between candidates, yet it is not out of the way for it to point out that consideration of more than one candidate for each of several offices is usually fortunate for the organization concerned. It makes the members think.

The American Institute of Electrical Engineers is an association of professional men, and they should be and are deeply interested in seeing that the Institute is so directed as to preserve and advance their professional aims and ideals in the best manner. There is no place in the Institute for the politics of state or national parties. The present election methods and machinery of the Institute may not be perfect, but when, as this year, members must choose between two or among more than two candidates they are automatically spurred to a definite consideration of who these candidates are, and also—and perhaps more important—they are impelled to a more direct notice and study of the activities and purposes of the Institute.

In the course of fifty years only fifty men can be president out of, say, two thousand fellows of that half century, and only two hundred and fifty men can be vice-president out of, say, fifteen or twenty thousand who are eligible. It is thus no disgrace not to be elected, but it is, on the other hand, a distinct honor to have been proposed.

The ELECTRICAL WORLD mentions these things at this time because it believes that it is to the interest of the electrical engineering profession that the Institute shall have maximum vitality. One factor in insuring this is that all members shall take a definite interest in the direction of the Institute and vote, and vote intelligently, on candidates for office. The ballots which were to be mailed yesterday should be used. The more widespread and representative the voting, the more constructive will be the result.

Charge of Monopoly Against Radio Manufacturing Companies

THE Federal Trade Commission has summoned before it eight manufacturers to answer the charge of monopoly of radio apparatus and communication. That these corporations have pooled radio patents is common knowledge and that they make radio apparatus of superior quality is also generally recognized. That their actions have tended to restrain trade is not so apparent, considering the thousands of manufacturers of radio apparatus in this country and the opportunities open to every youngster to buy radio parts in the five-and-ten-cent stores and to pick up the broadcasted programs without charge.

Certainly without the mobilization of patents that has taken place among these manufacturing companies radio communication would not be so far advanced as it is today. Whatever monopoly there is is presumably based on patents, and patent monopoly is guaranteed to inventors by the United States. That that guarantee also extends to the holders of the patents has been sustained in the highest courts. Unless, therefore, the Federal Trade Commission finds for adverse action some other grounds than patent monopoly, it is more than likely that the eight companies, after the charges have been heard, will receive a clean bill. Undoubtedly one basis of the charge is the cost of the patented radio tubes; but the radio art has required enormous expense in its development and the cost of this development must be spread over the apparatus resulting therefrom. The public has been willing to purchase these vacuum tubes in preference to vacuum tubes of other makes, and inasmuch as the United States uses many times more radio receiving sets than all the rest of the world put together, and considering that this growth has taken place within a comparatively few years, the public through such use has acknowledged the superiority of

the apparatus, even if those charged with the enforcement of the law have not. It is well, however, to have the situation thoroughly aired in the public interest.

The Retailer's and the User's Views of Electric Appliances

"WHEN we can get responsible salesmen who know the business, when there is sufficient margin of profit to advertise and allow for reductions on slow-moving stocks, and when either the appliances require less or the customers demand less servicing, then I believe that electrical merchandise will sell as any other merchandise." The foregoing is quoted from the article appearing on page 233 of this issue, wherein a department-store owner analyzes some of the difficulties of selling household electrical conveniences.

Because the retailer deals directly with the ultimate user it is illuminating to learn how the latter's views compare with those expressed above. Conversations with people not in the electrical business disclose certain definite things that the average householder thinks of electrical appliances. He recognizes and appreciates the convenience of "doing it electrically," his daily routine has been lightened in this way, and with him electricity is a popular topic for discussion. He wants to make further use of electrical appliances but finds two deterring elements: Prices look too high, and the devices do not stand the wear and tear of actual service that is expected of them.

There is no doubt of the universal popularity of electrical applications. Merchants generally see in this a great commercial opportunity. Developments have, however, outstripped the average knowledge of the subject, and there are not enough men with selling ability equipped to explain intelligently to lay buyers how to use and care for an electrical device.

On the question of serviceability the retailer and the user check closely. It is evident that means for insuring more rugged construction or design are needed on some devices, for the dealer cannot and should not have to make so many free repairs. The user rightfully expects that the device he buys will give him service without being pampered, just as he expects and gets good use out of his automobile or lawn mower or phonograph.

The matter of price appears to need adjustment in several places. For the user it is too high; the retailer complains of too little "spread"; the jobber preaches quicker turnover, while the manufacturer calls for a larger volume of business so that he can lower production costs and consequently reduce prices. The fact is, though, that a number of non-electrical dealers are selling some standard lines considerably below list prices by purchasing direct from manufacturers, and they claim to be making money.

From these viewpoints three important changes in existing conditions should develop. First, if the electrical appliance business is to reach the proportions believed possible, it is most desirable that the general construction and design be so strengthened that appliances will withstand a very considerable amount of rough usage. Second, the public believes that present prices are too high, and it seems inevitable that they must drop to a point where voluntary demand will more nearly compensate aggressive selling effort. Third, if satisfactory retail distributors are to be maintained, equally attractive discounts and privileges should be extended to all classes of dealers whose sales volumes are fairly within the same range.

Another Useful Distribution Formula

ANOTHER useful tool is added to the equipment of the distribution engineer by Austin Burt's article on the quick calculation of distribution lines, printed elsewhere in this number. He translates the simple approximate formula given in a previous article from the terms applicable to transmission to the form most convenient for the shorter lines involved in distribution work. This method, like the transmission method, is approximate, and Mr. Burt gives not only the result of applying the method but the result from the application of the accurate methods. Too much of the ordinary distribution work is done by guess because the formulas ordinarily used are too cumbersome to carry in mind and so are not used unless the engineer is at his desk.

Uniform System Insulation or Protective Safety Valves?

IN HIS article in this issue Dr. H. Norinder announces the conclusion, reached after investigating thunderstorm fields for several years, that insulation breakdowns resulting from lightning discharges are due to secondary surges of steep wave front which are set up by insulator flashovers or horn-gap discharges. He finds that lightning discharges are unidirectional and pulsatory, slow, non-oscillatory and highly damped, and that the resulting primary line surge may have a high amplitude but always has a sloping wave front. Finally, he infers that insulation of uniform strength on line and connecting equipment is the best protection and that horn gaps and lightning arresters are superfluous if not hazardous to the system because they establish weak points for the setting up of steep-wave-front secondary surges. Dr. Norinder's conclusions that induced strokes are impulses are borne out by a similar investigation by De Blois and by observations by Peek. These investigators, however, have observed impulses of steep wave front as well as slanting wave front.

This very elaborate field investigation is a splendid contribution and should lead to new developments and new research to establish beyond question the merits and demerits of the American system of lightning protection. If our practice is not best, researches should establish that fact, and these researches can be made apparently at little expense on a large scale in the field where conditions are identical with service conditions. Field work, however, should be supplemented by laboratory work where conditions can be controlled.

It must not be inferred, in view of the apparent logic in the development of protective equipment, that the thunderstorm field has not been investigated in this country. As early as 1907 and 1908 Peek and Creighton made field researches in Colorado, and later an investigation was made by De Blois of the actual characteristics of the disturbances that occur on a line. But despite these researches a complete knowledge of atmospheric conditions is lacking, although absolutely essential to a fundamental solution of the problem of line protection. The available meteorological records indicate that at a height of about six miles the earth is covered with a deep isothermal layer of atmosphere whose temperature is about —55 deg. C. At the earth's surface the potential gradient ranges from 110 volts per foot to 500 volts per foot, depending on the season of the year and the moisture present. From the ground to the isothermal layer there is a normal potential of about a million volts with the gradient

decreasing as the altitude increases. Yet over a hundred millions of volts is required to produce a lightning flash. Where does this potential originate?

Ronalds, Chree, Lodge, Steinmetz, Peek and others have made researches tending to show that a continuous upward electronic stream flows from the earth to the atmosphere due to the vertical potential gradient, and that the electric strength of air decreases to a minimum at an altitude of about 30 miles, where it again begins to increase. Hayden has proved that in vacuo a much higher gradient is required for breakdown than in air, and Peek proved that impulsive voltages required to break down air must be much greater in magnitude than the voltage waves used commercially. It is also known that the electric resistance of a fog or mist is higher than that of clear air and that its electric strength is about the same.

Based on these notable but unco-ordinated researches, Dr. Russell has built up a theory on the mechanism of a thunderstorm which has been pretty well accepted by scientists. According to this theory the normal electronic atmospheric current assists in starting the thunderstorm, which gradually accumulates immense quantities of energy as it travels over considerable distances. In the center of a thunderstorm are upward air currents moving at high velocity and sometimes many free electrons. When the humidity is high vapor condenses on these electrons to form globules of water some of which are pulverized by the air velocity and some of which fall to lower strata. The larger drops have negative charges and the small ones positive charges. As the drops form and re-form and are subjected to the work of gravity or air velocity in the manner described, electrical energy accumulates in the atmosphere with an upper stratum of negative polarity and a lower one of positive. As this continues the potential gradient increases until a disruptive discharge occurs, and Dr. Norinder shows that very rapid regenerative action then ensues until other discharges follow. He also shows that the volume of atmosphere involved in the discharge is rather limited and states that only when this sudden discharge occurs near a line is the line charge released and voltage surges set up in the line.

Brush discharges between strata, discharges between lower or upper layers of the atmosphere, as well as the discharges to earth and many other forms of lightning, occur according to particular conditions. Most of the underlying phenomena are based on theory and some exact research data, but the conclusions of Dr. Norinder indicate quite clearly his opinion that lightning protective practices on the well-insulated high-voltage transmission lines and equipment in this country as applied in horn gaps and arresters may have been extrapolated too rapidly.

Even the magnitude of the voltage of a lightning bolt has long been a matter of speculation. For relatively short distances a spark jumps about one foot for each 150,000 volts. There has been no assurance, however, that the voltage of lightning could be determined by multiplying the sparking distance in feet by this factor. In fact, it has been generally believed that the voltage was very much lower than would be indicated by the length of the flash. Exact data on natural phenomena are often very difficult to obtain because no two conditions are ever exactly alike.

Peek's lightning generator at Pittsfield affords a powerful new tool for laboratory research work, and much progress has already been made in the study of the ground wire and lightning protection in general. In a lecture before the Franklin Institute last November Peek described a test with artificial lightning which in combination with field observations apparently gives a very simple means of almost directly determining the voltage of lightning. Under certain field conditions as to height and distance of the cloud from a transmission line, it has been observed that the voltage induced on the line is of the order of a million. A test in the laboratory with these natural conditions to scale showed that the voltage induced on an artificial line was one per cent of the voltage of the artificial flash. It appears, therefore, that the voltage of lightning is of the order of a hundred million. The unit sparking distance seems to correspond to low-voltage values.

Peek further showed that the induced voltage depends upon the voltage gradient in the vicinity of the line, which he states must have been of the order of a hundred thousand per foot (300 kv. per meter) to correspond to a lightning voltage of a hundred million. It is a noteworthy fact that Dr. Norinder measures gradients of the order of 300 kv. per meter (100 kv. per foot), which Peek states must exist if the lightning voltage is of the order which he estimates.

It is doubtful whether many engineers in this country, where lightning arresters have been most highly developed, would discard them. However, the horn gap without a proper arc-suppressing device, which Dr. Norinder apparently has in mind, has long been out of use here because it does produce the oscillations of an arcing ground, of which he complains.

Only more extensive laboratory tests and field researches of a character similar to those of Dr. Norinder and Mr. Peek can determine whether it is better to design the very high-voltage systems with uniformly strong insulation at all points or to apply what have been considered safety valves in the form of horn gaps or arresters at one or several locations.

Popular Booklet on a Modern Generating Station

ALL attempts to acquaint the public with fundamentals of the electric light and power business are not successful. Many of them fail because of the manner of presentation. Oftentimes the language employed is too technical, the method of approach faulty, or the story lacking in human qualities or interest. Good will is altogether a matter of human relations and must be approached in a human way. A story worth telling is worth telling well. To bankers it must be related in one way, to engineers in another and to the general public in still another. In every case the story must be fitted to the audience. One of the best booklets that have come to our editorial notice in some time has been written around the superpower plant of the Union Electric Light & Power Company of Illinois, located at Cahokia. It describes the new power plant popularly but accurately, tells of its size, why it was built at Cahokia, how the electricity is generated from steam, and without going into technicalities it shows why the station is one of the most efficient in this country and why it will mean so much to St. Louis. As a piece of literature about an electric power plant intended for community consumption "Cahokia" is worthy of note. Managers of other properties might read it to advantage, not because of what it says, but because of how it says it. Electric public utilities are seeking good will, and they should not go about it aimlessly, but intelligently.

Huntington Beard Crouse

An electrical manufacturer who has distinguished himself both in the creation of a product of unique quality and in service as a counselor to his industry.

IN EVERY industry there are leaders. But among those leaders there inevitably stand out a few men whose wisdom and judgment have won for them a special recognition. It is to these men that the industry goes for counsel in time of need, and such is the enviable position in which H. B. Crouse, president of the Crouse-Hinds Company, Solvay, N. Y., stands in relationship to the manufacturing branch of the electrical industry today.

Born in 1872, in Fayetteville, N. Y., Mr. Crouse entered the electrical business immediately upon graduation from Andover, joining an organization already established by his father for the manufacture of panels and switches, the organization which later became the Crouse-Hinds Company. Working up through the business, he came into control in 1905. He took a plumber's fitting and transformed it into an electrical "quality" product that has won a unique position in the industry. He has established his company in the front rank and himself in a position of acknowledged leadership. He has done this by the virtue of his constructive policies, his broad vision, his loyalty to economic principles and his generous service in the furtherance of electrical progress.

Mr. Crouse is rated as a conservative, but it might better be said that he is a believer in orderly procedure who works along organized lines. For he has been a pioneer in the preaching and application of better business methods in the electrical industry. It was he who took the initiative in organizing the detailed study of the cost of distributing electrical supplies that was conducted by the Electrical Supply Jobbers' Association last year. He has been a stanch supporter of the National Electrical Code. He has been a constant and influential worker for the advancement of the art through the improvement of standards of electrical materials and workmanship. He has been a powerful advocate of just reward for the distribution and the merchandising of all electrical commodities through liberal margins of profit for service rendered.

Mr. Crouse is a man of great energy and force who adheres to the principles he believes in with a remarkable tenacity of purpose, and it is these qualities which have won him his position of influence in the industry today. He is one of the past-presidents of the Associated Manufacturers of Electrical Supplies.

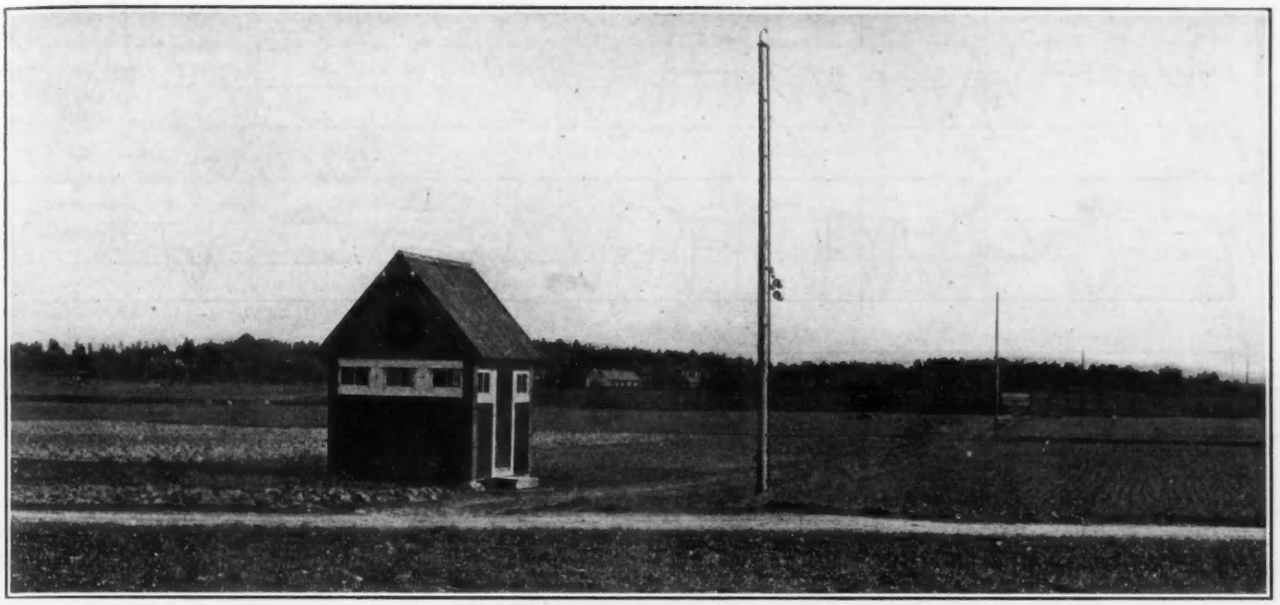


FIG. 1—OBSERVATIONS WERE MADE BY MEANS OF TWO LONG, HIGHLY INSULATED STEEL WIRES
These wires were stretched horizontally one above the other—5 m. to 10 m. above the ground. Instruments were housed in the building shown

Electric Thunderstorm Field Researches

Investigation Shows that Good Line and Transformer Insulation Affords Better Protection Against Surges and Is Superior to Horn Gaps and Lightning Arresters

By Dr. H. NORINDER
Upsala, Sweden

A DISCUSSION of the protective value of ground wires, lightning arresters and other safety measures against atmospheric surges should be based upon exact knowledge of the general electrostatic field conditions of thunderstorms. The Royal Board of Waterfalls of Sweden, therefore, some years ago began a series of systematic investigations of the earth's field during thunderstorms.*†

The first problem to be dealt with was to determine the magnitude of the field gradient near the earth's surface, since on this gradient depends the charge induced per unit length of conductor. Other important considerations having an immediate bearing upon the question of the total energy of atmospheric surges are the extension along the earth's surface of the dangerous field intensities due to thundercloud charges and the extension in space of the volumes discharged by one thunderbolt.

It was soon found that a slowly varying thunderstorm field, be it ever so intense, never can give rise to any high voltages on the lines, even if the neutral is not grounded. When clouds pass over the line and thereby cause a change of field, the conductivity of porcelain insulators is sufficient to allow the charges to equalize themselves so that the transmission-line wires always maintain practically symmetrical and undisturbed three-phase potential. Only as the field is broken down very rapidly—as, for instance, by a flash of lightning—is the charge on the line suddenly set free and a voltage surge set up. Interest, therefore, centers on the rate of change of the gradient, and a careful study is being made of the exact form of field variations due to lightning. For this purpose and also to obtain direct records of atmospheric surges on electric transmission lines a special form of cathode-ray oscillograph has been

*H. Norinder, *Tekniska Meddelanden fran Kungl. Vattenfallsstyrelsen*, Jan. 15, 1921.
†H. Norinder, *Teknisk Tidskrift, Elektroteknik*, Oct. 6, 1923.

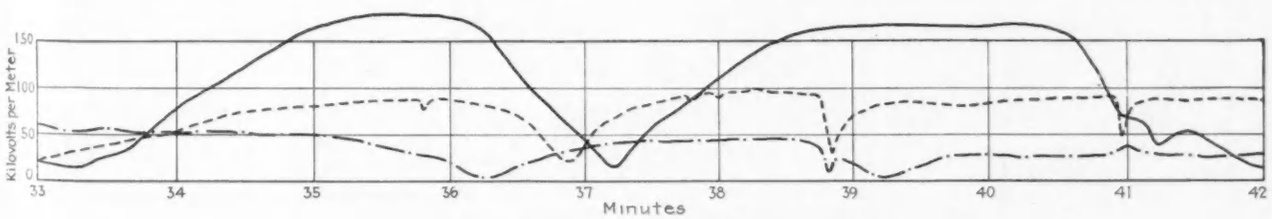


FIG. 2—SIMULTANEOUS RECORDS OF THUNDERSTORM FIELDS
Taken at three stations situated at the corners of an equilateral triangle having sides 10 km. long

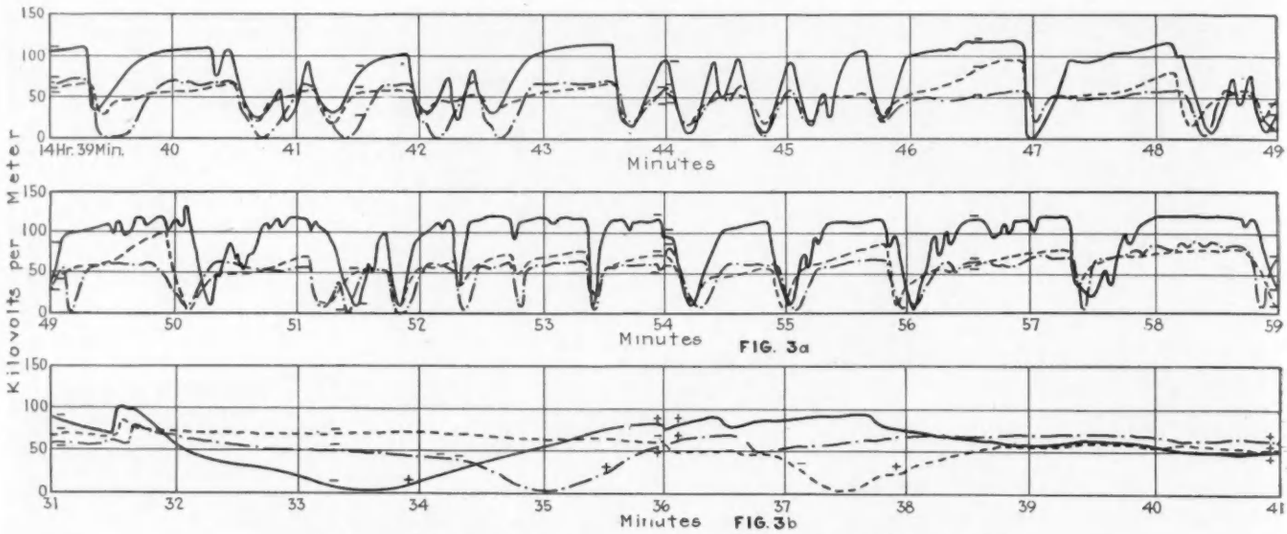


FIG. 3—THUNDERSTORM FIELDS MADE AT STATIONS 1.4 KM. TO 2.2 KM. APART

(a) Regenerative action in the clouds is shown and a rapid building up of charge after each discharge. (b) Records taken half an hour after the storm had subsided show a gradient change from negative to positive.

developed. By means of this observations have been made of a number of lightning discharges, which show that the discharge is rather slow and non-oscillatory. Voltage surges set free by lightning therefore probably have a pronounced slanting front. The inference is that these very steep waves, which often cause punctures in transformers between adjacent turns or coils, are caused by secondary discharges across the insulators.

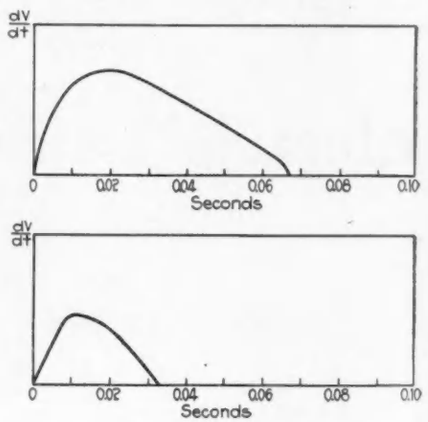


FIG 4— TWO OSCILLOGRAMS SHOWING THAT FIELD CHANGES ARE APERIODICALLY DAMPED, NON-OSCILLATORY AND RELATIVELY SLOW

INTENSITY OF THUNDERSTORM FIELDS

Observations were made by means of two long, highly insulated steel wires, stretched horizontally, one over the other, about 5 m. to 10 m. above ground, as shown in Fig. 1. The wires were provided with radio-active "collectors" so that each one rapidly took on the

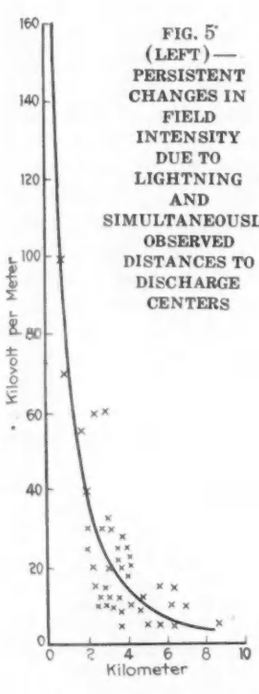


FIG. 5 (LEFT)— PERSISTENT CHANGES IN FIELD INTENSITY DUE TO LIGHTNING AND SIMULTANEOUSLY OBSERVED DISTANCES TO DISCHARGE CENTERS

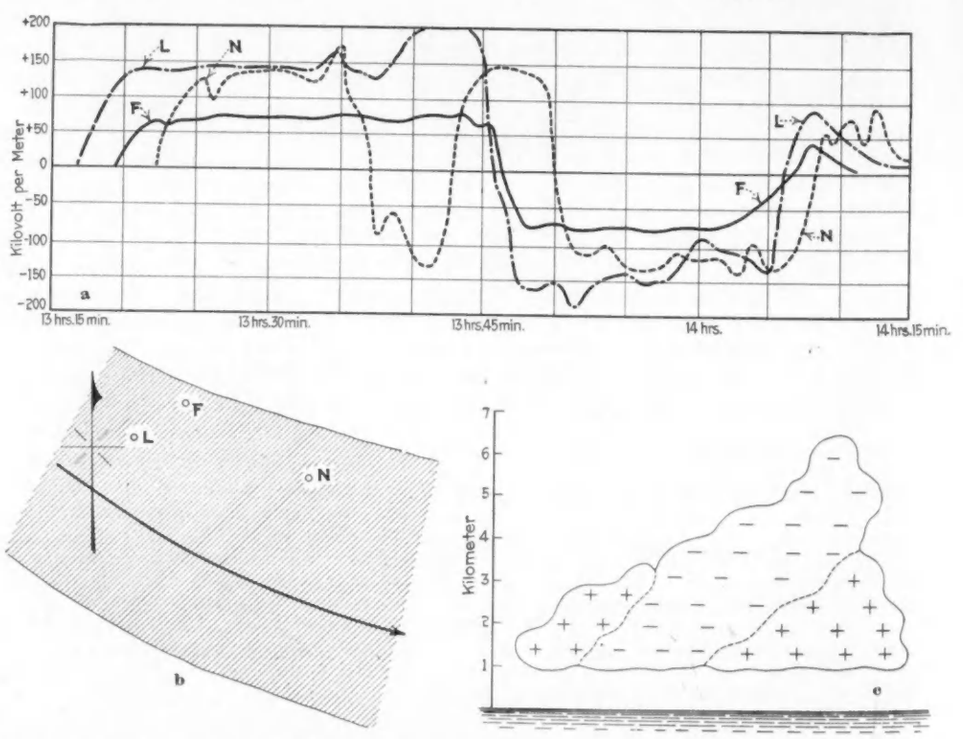


FIG. 6—A HIGHLY CHARGED THUNDERSTORM CLOUD PASSING SUCCESSIVELY THREE OBSERVATION POINTS 1.1 KM. TO 4 KM. APART

(a) Records upon passing L, F and N. (b) Path of the cloud. (c) Approximate section of the cloud in the direction of its motion

potential existing in the field at the height of the wire. Special bakelite-treated hard-rubber insulators with drying-chambers around them supported the wires, as porcelain insulators proved worthless for the task. The potential difference between the wires was registered by a special high-speed recording static voltmeter. Observations were made and records of the field variations taken at five stations in different localities.

The first noteworthy result of this research was to establish beyond doubt that field intensities of the order of 100 kv. to 150 kv. per meter are common during thunderstorms at about the height of a normal power transmission line. Pressures of 200 kv. per meter have also been recorded. A closer study of the records shows that in the regions near the lightning path field intensities of the order of 300 kv. to 400 kv. per meter may exist, and that very likely the corona limit sometimes is reached in the charged volumes. The field direction was just as often found to be positive as negative, depending upon the situation of the observation points with respect to the inducing charges.

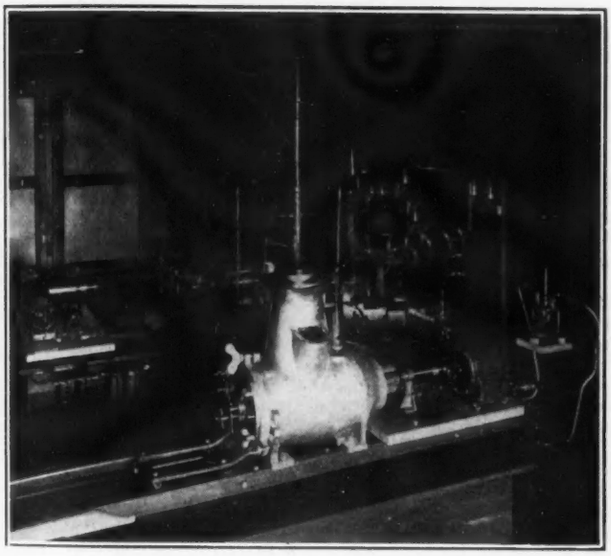


FIG. 7—SPECIAL CATHODE-RAY OSCILLOGRAPH DEVELOPED FOR THUNDERSTORM RESEARCH WHICH RECORDS LINE SURGES

In order to determine how far the discharging action of a lightning flash reaches, the field was simultaneously observed in three stations situated at the corners of an equilateral triangle of about 10 km. side length. Fig. 2 shows three such simultaneous records of thunderstorm gradients, the three stations having different types of lines. The ordinate gives the absolute value of the gradient in kilovolts per meter, with positive and negative deflections going in the same direction.

It will be observed that the three curves have very little in common. Just before 39 min. time there is a dip in two of them, although the full-drawn curve is quite smooth, and just before 36 min. time the dotted curve shows a dip which does not affect the other two. The records thus indicate that the field changes are rather local and do not extend over very large volumes. Even when field intensities of the order of 50 kv. to 75 kv. were observed simultaneously at two or three points 10 km. apart, a closer inspection of the records showed that the fields were made up of separate space charges, very often of opposite signs.

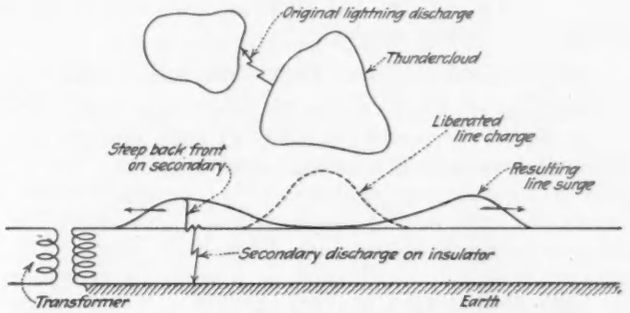


FIG. 8—HOW A LIGHTNING DISCHARGE STARTS LINE SURGES WITH SLANTING FRONTS

It is also shown how a secondary discharge on an insulator may give rise to a steep-back front of waves which may endanger intercoil insulation of transformers.

Observations were then made at points closer together, at distances of only 1.4 km. to 2.2 km. In Fig. 3 is reproduced a record obtained with this shorter base length, which very clearly shows that all three stations were then within the field of action of the same charges.

The record shows at 14 hr. 39 min. 20 sec., 41 min. 55 sec., 43 min., 35 sec., and so on, sudden changes in the field intensity. At all three stations, these changes were caused by lightning strokes, and in many cases the thunderbolt could be located a few kilometers away from the observation points. The first part of the record indicates clearly the strong regenerative action in the clouds. After each discharge the field rapidly builds up again toward a limiting value until the charge is again dissipated by a new flash of lightning. The next part of the record is rich in minor crinkles attributable to local brush discharges. Often the regions discharged by lightning are of very limited dimensions, and sometimes they do not exceed a sphere with a diameter of 1 km. Fig. 3b was made half an hour after a storm had subsided, and shows how the gradient at the three stations successively changed from negative to positive.

Persistent changes in field intensity due to lightning are few, but are sometimes seen in the records. In Fig. 5 a few such persistent field changes are plotted against observed distances from the station to the initial center of lightning. At a distance of from 3 km. to 4 km. from the discharge centers the field change was generally less than 20 kv. per minute.

A fine record of a highly charged thunderstorm cloud passing successively three observation points from 1.4 km. to 4.1 km. apart is shown in Fig. 6 (a). It should be noted here that the time scale is reduced, the whole diagram embracing one hour and that the records are given with correct signs. The sketches in Fig. 6 (b) and

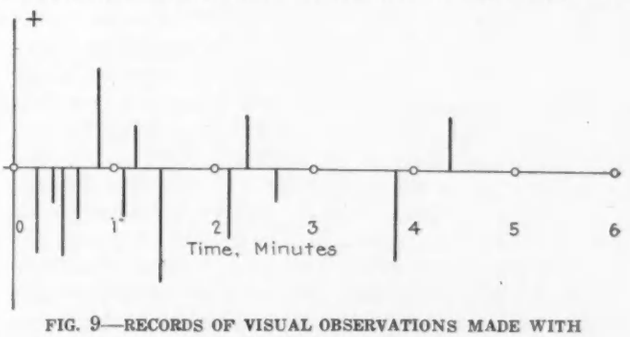


FIG. 9—RECORDS OF VISUAL OBSERVATIONS MADE WITH CATHODE-RAY OSCILLOGRAPH

Time in minutes and deflections of ray are laid off with proper signs and relative magnitude

(c) show the path of the cloud and an approximate longitudinal section of it.

TIME VARIATION OF THE FIELD DUE TO LIGHTNING

Field changes due to lightning were visually observed by the author during the summer of 1921 with the aid of a special cathode-ray oscillograph. Later this instrument was rebuilt and equipped with a recording drum, and on the basis of experience gained with this oscillograph a more refined instrument was built, which in its present form is shown in Fig. 7. During observations the deflecting plates of the cathode-ray tube were directly or capacitively coupled to a short-wave-length aërial. The aërial was aperiodically damped by a high ground resistance, and the charging current therefore closely followed the field variations, the oscillograph deflection being proportional to dv/dt.

A number of visual observations taken during an unusually severe thunderstorm in the summer of 1921 are illustrated by Fig. 9. The time is in minutes and the deflections of the fluorescent spot on the screen have been laid off with their proper signs and relative magnitudes. When lightning occurred the spot went from the zero position either to the positive or to the negative side and then returned to the zero position without once passing across to the opposite side.

From these observations one must conclude that unipolar impulses go from the antenna to earth or inversely. The aperiodically damped and non-oscillatory character of the lightning is thus indicated by visual observations. In Fig. 4 are reproduced two oscillograms of field changes due to lightning discharges obtained in August, 1922, which confirm the result of the visual observations of the preceding year. The field variation recorded is aperiodic and relatively slow. Although the effective resistance, capacity and inductance of the lightning path changes widely in a thunderstorm field, so that the discharging time probably varies within rather wide limits, the observations seem to indicate very definitely that the lightning discharges are highly damped.

CONCLUSIONS

It therefore seems unnecessary to assume the existence of high-frequency oscillations in lightning discharges, and the observations led to the following conclusions:

In its initial state a lightning discharge produces a voltage wave with high amplitude but slanting front. On its passage over the line this surge may produce a spark-over on an insulator or at some other weak point. This local discharge starts a secondary discharging surge front of greater steepness than the original disturbance, possibly even oscillatory, as suggested by Fig. 8.

Punctures between windings in transformers which are often interpreted as indications of high-frequency lightning discharges can sometimes be explained in that way. Evidently a horn-gap discharge is likely to have about the same effect as an insulator spill, and it may be that the power arcs following a secondary discharge in one place or another have a good deal more to do with transformer punctures than the atmospheric surges themselves. The inference is that the best system protection comprises strong line insulation and reliable interturn and intercoil insulation in the transformers, which make horn gaps and lightning-arrester equipment superfluous.

Hydro-Electric Development

Progress Made Toward Adoption of Larger Units Is Outlined by W. M. White in Boston Address—Trends in Practice Outlined

COINCIDENTLY with the starting of a 70,000-hp. hydro-electric unit at Niagara Falls, N. Y., preliminary designs for units of 100,000-hp. rating are on the drafting board, declared W. M. White, manager and chief engineer of the hydraulic department of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., at a recent largely attended meeting of the Boston Society of Civil Engineers. In a masterly review of the growing dependence of civilization upon power the speaker touched upon the potential and developed hydraulic resources of the world and pictured the latest advances in plant and equipment design. Economic studies indicate that the workman who can direct the greatest amount of power will receive the greatest wage. The table shows the relative development in three leading countries.

FOUR RANGES OF HEAD

In studying the problem of selecting hydraulic machinery, four major ranges of head should be considered:

1. *Standard Open-Flume Construction.* — This is generally used up to and including heads of 20 ft. Rarely is a spiral form used on this type of turbine. In some cases a nose or pointed obstruction is placed in the rear of the flume directed to divert the water smoothly into the guide chamber. The modern tendency toward larger units has made the vertical type more economical and efficient for the low heads. The tendency has been to increase the size under low heads, and as this has meant lower speed and greater generator costs, the demand has been insistent for higher speeds under the lower heads. Generator efficiency is poorer under lower heads. The Nagler type of high-speed propeller runner has met the situation well by providing practically double the speed previously possible on these low heads for a given power and head. The simplicity of the runner appeals greatly to operators who had previously been troubled with trash and anchor ice.

2. *Range of Heads from 20 Ft. to 60 Ft.*—Within this range the tendency is to equip units with concrete spiral casings and to equip the turbines with outside operating mechanism. The design of the hydraulic machinery fixes the center-to-center units in the power house within this range, rather than the electrical design. For economical reasons a concrete spiral casing must be kept as small as possible. It has been the Allis-Chalmers practice to place the nose of the spiral on the longitudinal center line of the power house. This provides that the water which passes downstream of the longitudinal center line of the power house in the spiral casing does not again pass upstream of this center line. The dimensions of the spiral may be made the least possible for a given limited maximum velocity of water.

HORSEPOWER (STEAM AND WATER) PER CAPITA AND DAILY WAGES

	Population	Total Hp. in Millions	Hp. per Capita	Average Daily Wages of Laborer
United States.....	106,000,000	35	0.330	$4.75
Great Britain.....	46,000,000	9	0.195	3.20
Japan.....	56,000,000	2.5	0.045	0.99

3. *Range from 60 Ft. to 300 Ft., or the "Metal Spiral" Range.*—The concrete spiral has been constructed for heads considerably above 60 ft. and steel spiral casings for heads as low as 45 ft., with economical results. Within this range lies the greatest development for the future, 70 per cent of the world's water powers thus being included. One-half the total horsepower of turbines built by the Allis-Chalmers company during the last four years falls within this range.

The plate-steel circular section spiral is being generally used for heads up to 225 ft., sometimes to 350 ft. The plate-steel spiral casing is a logical development, continu-

ing the plate-steel penstock around the turbine. Cast-steel spiral casings are used throughout the upper limits of this range. The difficulties of casting the sections of these large spirals have been overcome by casting the speed-vane ribs integral with the spiral casing and multi-sectionalizing the latter. Means has also been provided of sectionalizing the speed ring from the casing. So far the cast-steel spiral casing has been used exclusively for heads between 300 ft. and 850 ft.

The range of the impulse wheel overlaps that of the Francis turbine, beginning probably at 500 ft., coming into exclusive range at 850 ft. and having no upper limits except the strength of materials. The present upper limit of application is 3,000 ft.

The double overhung unit with a single jet on each wheel remains the standard and will probably be the leading type for several years to come. The efficiency of impulse wheels has been pushed up to remarkably high limits.

Draft-Tube Developments

The greatest advances in utilizing water have occurred of late in the improvement of the form of the passages from the runner to the tailrace. As the percentage of energy discharged from runners has increased with mounting sizes of wheels, the energy lost in draft tubes has also increased. This has forced setting the runner nearer the tailwater level than formerly. Larger diameters and shorter radii of curvature in curved draft tubes have been demanded, and the high specific speed of runners has led to an increased whirl in the water leaving the draft tube. The hydraucone draft tube provides for radially extending passages in which the whirling water may be made to pump itself out against the tailwater level, thereby increasing the wheel efficiency. Interest in draft-tube design is now at "fever heat."

The hydraucone draft tube is not limited to a flat plate or flat bottom. It provides a means for regaining the discharged energy effectively within a short space measured in the direction of flow from the wheel, thereby saving excavation. A new form of curved draft tube for utilizing a portion of the hydraucone has given fairly good results. This type is characterized by the lowering of the roof of the draft tube to form a concentration at the discharge end of the bend. This type of tube when used with a long section of a horizontally expanding draft tube gives effective regain, providing the form of the curved tube is such as to provide for substantially parallel stream flow lines of substantially equal velocity at the entrance to the horizontal portion of the expanding tube. The radially extending passages of the hydraucone draft tube provide for regain of the whirling water discharged from the runner when the turbine is operating at part load. Eighty per cent of the energy entering the hydraucone as velocity head is transformed into pressure head at the discharge.

Question of Specific Speeds

The formula $N_s = 5{,}050 \div (H + 32) + 19$, where N_s is the specific speed for a particular head and H the head, is convenient. As a rule, runners of higher specific speeds than those indicated by this formula will pit or erode, and they may do so below these speeds. In some cases it is more economical to select higher specific speeds than those indicated in the formula, because in the relation of the cost of generator and its increased efficiency to the cost of repairs or replacements from pitting the latter may be less. In selecting the limits of specific speed for a particular installation the varying cost of the generator in relation to specific speed should be carefully considered. In the case of large generators the speaker's company has found that there is a definite point of flexure in the curve of cost plotted in respect to speed, and in large units this point of flexure frequently corresponds to a lower specific speed than the formula indicates.

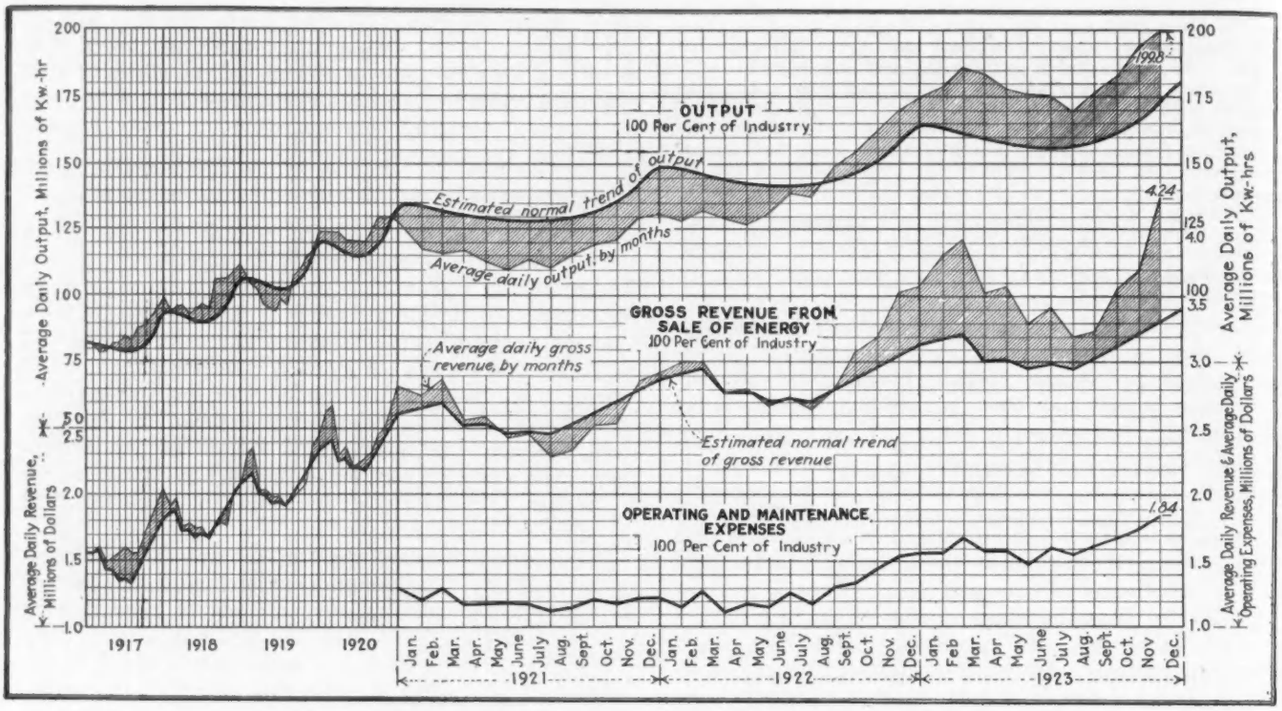
Remote Control Making Rapid Progress

Admirable control of governors now available from distant points no longer makes it necessary to place the governor beside the generator within jumping distance of the station attendants. In large plants with large units the distances between the switchboard and the prime movers are too great for satisfactory manual control. Automatic shutdown devices are coming into general use. Devices have been installed on the governor whereby the closing of a switch at the switchboard will automatically close the turbine gates, apply the brakes, trip the circuit breakers and open the field switches on the main machine.

The progress of automatic stations was then reviewed by the speaker. The remote control Peninsula plant of the Detroit Edison Company was put in operation in January, 1923, and the equipment was inspected in July and in October by a factory representative of the manufacturer of the prime movers, this being all the attention required from that source to the middle of December. The greatest development of the next few years bids fair to be the heads of 50 ft. and below for automatic station service, hitherto outside the range of economical cost.

In response to inquiries, Mr. White pointed out that, by proper designing of bucket ribbing, vibration and noise have been virtually eliminated in an impulse-type wheel with twenty-two buckets running 150 revolutions per minute under a head of 1,050 ft., the prime mover being of the double overhung type, rated at 30,000 hp. and served by water jets 10½ in. in diameter. Each bucket weighs 1,200 lb., and yet there is virtually no noise when one is standing beside the unit. Butterfly valves with metal packing strips are proving highly useful in obtaining automatic adjustment of packing to the shape of the housing in a 240-ft.-head plant. The use of the single-floor design of power house, as at the De Saola plant in California, is finding considerable favor. Governors for large units are being built with great sensitivity, a change of 0.001 in. in motion of flyball mechanism being sufficient to move the gates of the 70,000-hp. turbine lately installed at Niagara.

The speaker said that in designing 40,000-hp. wheel units the problems of safety, governing and efficiency were far more difficult than in advancing from 40,000 hp. to 70,000 hp. The governors of the large units will move the gates on a speed change of 0.1 per cent. The limiting factors in increasing the size of waterwheel units are chiefly the clearance of parts in railroad transportation and the size of shaft which can be forged and machined. Ultimately, the speaker anticipated the use of the Francis turbine on heads of 900 ft. to 1,000 ft. and 100,000-hp. ratings. Bearing problems have been so well solved in vertical units by Kingsbury that the popularity of bearings continues to be wide, and there are advantages in regard to the flow of water away from vertical units which tend to maintain their general use. Pitting may be due to nascent oxygen, although some authorities charge it against electrolysis. If occasion demands, the manufacturers will produce vertical impulse wheels.



THE CENTRAL STATION OUTPUT DURING NOVEMBER WAS 14.3 PER CENT ABOVE NORMAL AND THE GROSS REVENUE WAS 24.0 PER CENT ABOVE NORMAL

Record Central-Station Output During November

New High Figures for Average Daily Output, Average Daily Gross Revenue and Total Revenue During Any One Month

THREE new records were hung up by the electric light and power industry during November. Reports for the month received by the ELECTRICAL WORLD from electric generating and distributing companies representing 72 per cent of the installed generator rating of the country indicate that the average daily output was 199,846,000 kw.-hr. This exceeded the previous record made during October by 5,546,000 kw.-hr. The total output for the month, however, was slightly below that of October owing to there being one day less in November. In addition the average daily revenue from the sale of energy during November exceeded any previous figure by $4,243,000, and the total gross revenue for the month, $127,200,000, was also a record.

A study of the accompanying diagram indicates that the central-station output during November was about 14.3 per cent above what it would have been if energy requirements of the industry had been normal. During July the industry was operating at 8.2 per cent above normal. A significant fact to be drawn from the November returns is that while in January of last year the output was 28.6 per cent above the output of January, 1922, the output for November of last year was only 12.5 per cent above the output for November, 1922. This unexpected drop in the output over the preceding year will probably result in estimates made for the total output for the year being decreased to some extent.

The gross revenue from the sale of energy for the month of November was 24.0 per cent above what would have been the normal revenue if the growth of the industry had been normal. This is a material gain over previous months. It must be remembered, however, that there is a certain lag to revenue statistics and that the data for any one month is not in any way comparable with the energy sold during that month.

Every section of the country reported a material gain in operations over October. The largest gain was reported from the Atlantic States. A very slight gain was reported by the Mountain-Pacific States, which was undoubtedly due to the decrease of irrigation requirements due to the advancing season.

The "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" for November indicates that the industry as a whole was operating at 7.6 per cent above the point of normal demand. It would appear, therefore, from the above figures that activity in the electric light and power branch of the industry during November was materially above that of the electrical industry as a whole in so far as sale of energy was concerned.

TABLE I—CENTRAL-STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1923 Thousands	1922 Thousands	Per Cent Increase
Sept....	75	4,085,761	3,552,726	15.0	69	$73,837	$65,384	12.9
Oct....	74	4,459,306	3,812,744	17.0	68	78,043	69,010	13.1
Nov....	72	4,316,711	3,836,676	12.5	66	84,064	74,706	12.5

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies Reporting) 1923 Thousands of Dollars	1922 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1923	Steam Plants 1922	Hydro Plants 1923	Hydro Plants 1922	Combined Systems of Steam and Hydro 1923	Combined Systems of Steam and Hydro 1922
Sept....	59	29,819	27,032	10.3	51.1	55.2	31.4	22.4	53.5	52.6
Oct....	58	31,516	28,519	10.5	49.0	52.1	28.0	28.9	54.8	48.8
Nov....	56	31,022	28,601	8.5	48.2	50.4	27.3	24.3	52.6	46.0

Electricity in the Oil Fields*

Progress Made in Supplying Equipment and Types of Applications—Comparative and Actual Cost Data on Drilling and Pumping—Energy Consumption and Rates Charged

By W. G. TAYLOR
Industrial Engineering Department, General Electric Company

IN THE oil fields having it available electric power is used extensively to drive water pumps, gathering and line pumps, vacuum pumps, compressors for natural gasoline plants and circulating pumps in these plants. No less important are electric dehydrators, arc-welding equipments for pipe line and tank construction, motor drive for machine shops, and general lighting about the fields. The greatest as well as the most important use of electric power, however, is in drilling the wells and in maintaining them as producers by pumping, pulling and cleaning them.

The motors used for drilling differ from those used for pumping. The larger motor used for drilling would not be nearly so economical in power consumption on pumping, if it were used in place of the motor designed particularly for that work.

The drilling motor, usually 75 hp. in capacity, is used for either cable-tool or rotary work and is supplied with control apparatus which not only gives the fine speed adjustment necessary in cable-tool drilling, but also gives the right motion of the tools required for effective drilling. The control apparatus for a drilling motor also gives all the speed control needed at light loads to handle such work as spudding-in, fishing and tonging pipe, and in general closely duplicates or improves upon the results obtainable with steam. Two rope wheels on the "headache post" at the derrick give the driller complete control of the motor.

The same drilling motor equipment used for cable tools is suitable without change for the main drive on a rotary rig, the only difference in the set-up being that the motor, instead of being belted through a countershaft to the bandwheel, is coupled to a gear reduction unit which drives the draw works by standard rotary chain. Separate motors are provided for the slush pumps. It has until recently been the practice to use one motor for the two pumps, shifting from one to the other as required, but the better plan now being adopted is to provide a separate motor for each pump, thus making them entirely independent of each other. Where protection against gas is advisable on account of the particularly bad gas conditions the controller and switches are immersed in oil and the slip rings of the motor suitably inclosed. The entire motor has been inclosed in some instances, a number of such outfits having been built for the Baku field in Russia.

Cost of Drilling by Electric Power

In comparing the costs of drilling by various forms of power, it is necessary to eliminate all items not influenced by the power used, in order to avoid introducing factors which vary widely with the underground conditions and with the luck encountered. A comparison of this kind was recently made by the Pinal Dome Corporation, operating in California and Texas. Three wells were considered, one drilled by electric power to a depth of 5,108 ft., another by gasoline engine to a depth of 5,208 ft., and the third by steam engine to a depth of 3,955 ft. The loss of time due to shutdowns of the motor was 121 hours, gasoline engine 202 hours, and steam engine, including boiler, 328 hours. This indicates a material advantage in motor operation. The average cost of power per foot drilled was 82.1 cents for electric power, 85.5 cents for gasoline and $2.49 for steam. This comparison is not a proper one, however, as the amount of power required per foot drilled will vary with the formations encountered, and so it is not as true an indication of relative cost as the average cost of power per operating hour. This was, per hour, as follows: Motor, 40.7 cents; gasoline engine, 8.3 cents; steam engine, 93.8 cents.

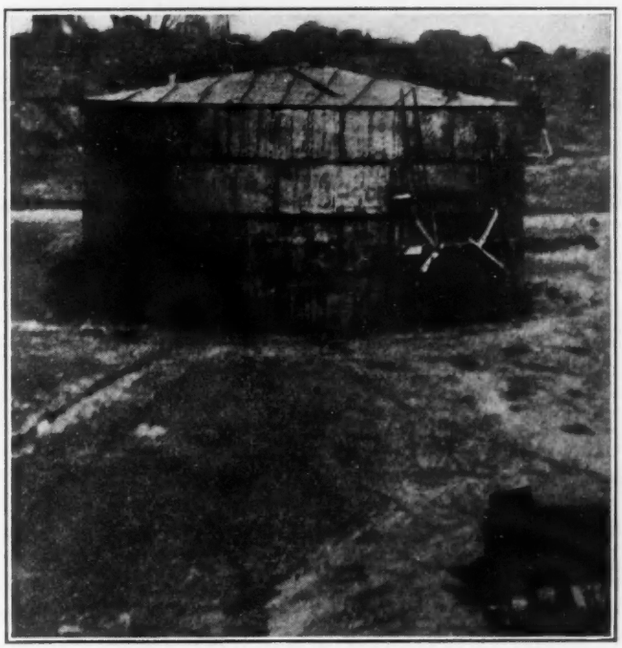


FIG. 1 — AN ELECTRIC ARC-WELDED OIL STORAGE TANK, 43 FT. IN DIAMETER AND 20 FT. HIGH, FOR THE OKLAHOMA PRODUCING & REFINING COMPANY AT MUSKOGEE

These figures speak for themselves and are further substantiated by records of other companies. The Empire Gas & Fuel Company, for example, compared the cost of electric power for drilling a 2,440-ft. well in Kansas with the average cost of steam drilling on similar wells and determined the total saving in cost of power to be $1,585, which amounted to $46.62 per day of actual drilling. Many other records show the economy of electric drive for all types of drilling.

Rotary drilling by electric power in California is proving very economical, and some figures obtained on

*Abstract of paper presented before the American Petroleum Institute, St. Louis, Dec. 12, 1923.

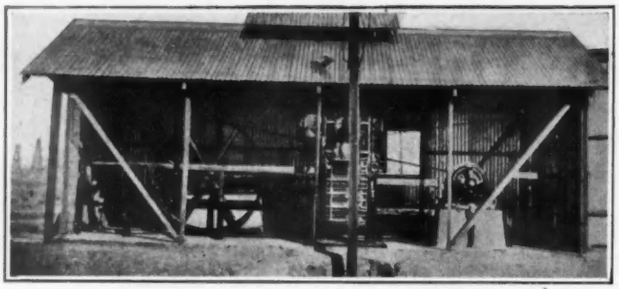


FIG. 2—A 440-VOLT TWO-SPEED OIL WELL MOTOR INSTALLED IN THE COALINGA OIL FIELDS IN CALIFORNIA

two different wells are good examples. The Nevada Ventura Oil Syndicate in the Signal Hill Field at Long Beach operated an electrically driven rotary rig for thirty-one days in January, 1922, with a 75-hp. motor on the draw works and rotary table, a 50-hp. motor on the slush pumps, a 0.5-hp. motor on the blower, 5 kw. in lights and three electric ranges on the lease. The power bill was $501, an average of $16.16 per day. A steam-driven rig, operating across the road from this well and burning oil under the boiler, averaged $92 per day for oil fuel and boiler-feed water during the same month. Both rigs ran throughout the month without delays and made about the same amount of hole per day.

The San Martinez Oil Company drilled a well to the producing sand in thirty-eight days, using an electrically driven rotary rig. A nearby well of another company was started on the same day and drilled by steam power, and the crews of the two rigs had a race with each other. Both wells had the casing set at the top of the sand the same day, thirty-eight days after starting; both were cemented at the same time, and both reached production on the same date. The race was particularly interesting because at the outset the electrically drilled well got behind, the crew drilling with steam making hole faster at the start. Toward the end, as the crew on the electric rig became more proficient, they gained rapidly on the steam rig and completed the well on the same day at approximately the same depth. During the entire performance there was not a single accident of consequence on the San Martinez well, but on the steam-drilled well there were a number of "twist-offs" and expensive accidents. The power cost on the electrically drilled well averaged $15.81 per day, while the steam rig cost about $100 per day for power.

The cost, including installation of the electric and steam equipment at the two wells, was practically the same, but the salvage value of the electrical equipment at the completion of the well was estimated at about 90 per cent of first cost, while the steam equipment was worth considerably less.

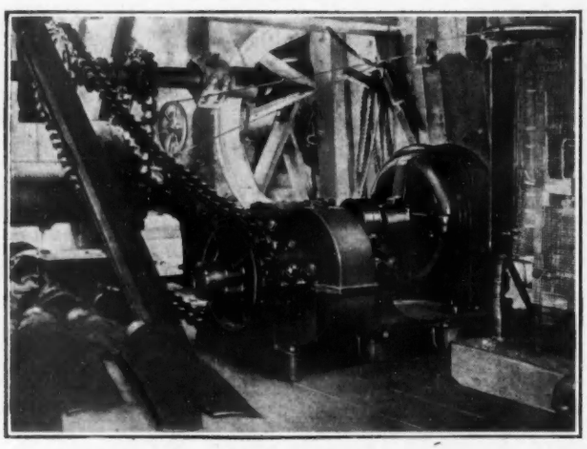
TABLE I—COMPARATIVE COST OF OPERATION WITH ELECTRIC MOTORS AND GAS ENGINES

First Cost per Unit—25 Units		
30-hp. engine installed ready to run		$2,400.00
30/15-hp. motor installed ready to run, including transformers and primary lines		2,200.00
Annual Fixed Charges per Unit—25 Units	Gas Engine	Motor
Interest on investment at 6 per cent	$144.00	$132.00
Depreciation, engines 10 per cent, motors 5 per cent	240.00	110.00
Maintenance, engines 5 per cent, motors 2 per cent	120.00	44.00
Belt maintenance, engines 20.5 cents, motors 10 cents per day	74.83	36.50
Insurance and taxes, 2 per cent	48.00	44.00
Total fixed charges per unit per year	$626.83	$366.50
Annual Operating Costs per Unit—25 Units	Gas Engine	Motor
Engine lubricating oil, 180 gal. at 38 cents	$68.40	.....
Motor and countershaft lubricating oil, waste and cleaning	.....	$9.60
Nine pumpers, three per shift, at $5.25 per day	689.85	.....
Six pumpers, two per shift, at $5.25 per day	.....	459.90
One gas-engine man, at $6.75 per day	97.20	.....
One gas-engine helper, at $5.50 per day	79.20	.....
One electrician hired from electrical contractor at $10 per day, half time required	.....	72.00
Power, 6.76 kw. input for 24 hours, 365 days, or 59,217 kw.-hr. at 1 cent	.....	592.17
Operating cost per unit per year	$934.65	$1,133.67
Fixed charges per unit per year	626.83	366.50
Total cost per unit per year	$1,561.48	$1,500.17

The mere fact that gas is available on a lease does not make the gas engine the logical or the most successful type of power equipment for pumping the wells. The cost of operation is usually the determining factor, reinforced by whatever additional advantages the equipment under consideration may have. Some of these additional matters for thought are safety, reliability, convenience and speed regulation.

Consideration of the gas engine and the electric motor for oil-well pumping resolves into the question of costs of operation. For ready comparison, data on fixed and operating charges are submitted in Table I, based on a lease with twenty-five units. In preparing this tabulation the data which have been used have been obtained from various oil operators who have kept records. It has been necessary to co-ordinate the results of several companies, as no one company had this data complete with all items segregated, but this in no way alters the value of the data.

Under the conditions illustrated by Table I motors are



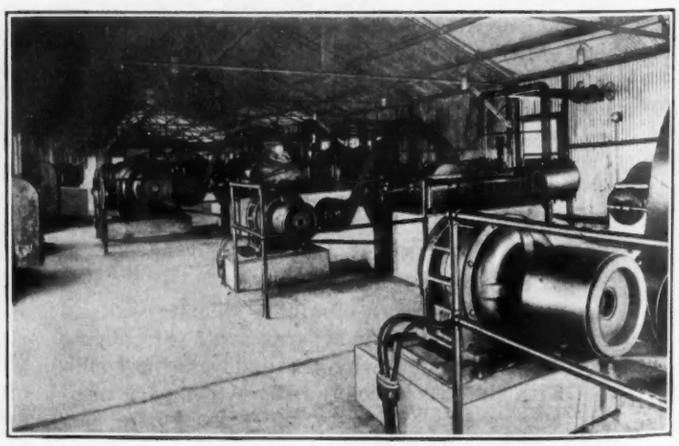


FIG. 3 (AT LEFT)—A 440-VOLT MOTOR DRIVING A ROTARY DRILLING RIG AT REDONDO, CAL FIG. 4 (AT RIGHT)—MOTOR-DRIVEN COMPRESSORS AT CHESTNUT & SMITH'S CASING-HEAD GASOLINE PLANT AT RANGER, TEX.

TABLE II—POWER CONSUMPTION OF TYPICAL INSTALLATIONS

	Kw.
(1) Coalinga field, California. Average input per well for five months for eleven oil companies with twenty-three motors on representative wells	3.63
(2) Santa Maria, Casmalia and Cat Canyon fields, California. Average input per well for five months for eight oil companies having sixty-three motors on representative wells	6.76
(3) McKittrick field, California. The Berry & Keller Oil Company, eighteen oil-well motors and two shipping-pump motors. Average input per well, including pumps	4.22
Associated Oil Company, thirty-two oil well motors. Average input per well	3.33
(4) Maricopa field, California. Berry oil interests, forty oil-well motors. Average input per well	3.25
Tannehill Oil Company, ten oil-well motors. Average input per well	3.33
(5) Elk Hills field, California. Standard Oil Company, six oil-well motors. Input per well determined from instantaneous readings	8.15
(These are particularly heavy wells and do not represent the average conditions in the field. The figures are not true averages but are given to show an extreme case of selected heavy wells.)	
	Kw.
(6) Kern River field, California. Associated Oil Company, 215 oil-well motors. Average input per motor	3.60
(This includes a number of jack plants which cannot be readily segregated.)	
	Kw.
(7) El Dorado and Augusta fields, Kansas. Average input per well for two months for about twenty-five oil companies having eighty-one average wells	4.58
(8) Gulf Coast fields, Texas. From records of the Gulf Production Company, the Humble Oil & Refining Company and others, the average input for the various fields where a large number of motors are installed is	5.20 to 6.00

more economical than gas engines, even without including any charge for gas or water for the engines, without taking account of the greater percentage of time lost from shutdowns of the engines and capitalizing the resulting loss in production, and without capitalizing the decreased number of pulling jobs due to reduction of rod trouble when motors are used. Furthermore, the power consumption assumed represents the heaviest set of pumping conditions encountered almost anywhere in the country, considering the wells as a group, and it would be much fairer to the motor to use a lower figure representing more nearly average conditions.

POWER CONSUMPTION AND RATES

It is assumed that gas for the engines can be obtained from the lease without cost. Often, however, the gas has a market value or must be purchased, in which case the cost must be charged against the engine.

Similarly no charge is made for circulating water, although in many cases it must be purchased or pumped at considerable expense. Thirty-six dollars per engine per year is a fair figure for many California fields. It costs the Empire Gas & Fuel Company in Kansas an average of $108 per engine per year. For ten engines at Maricopa, Cal., it averages $42.48, and the General Petroleum Corporation some time ago found its average was $15.

There is no justification for assuming in a comparison of this kind that the electric power input to the motor at each well will average as high as 11.9 kw. or even 8.5 kw. Correct conclusions cannot be drawn unless figures are based on actual field conditions rather than selected arbitrarily. Examinations of power companies' ledgers and of oil companies' monthly bills have been made, and the records obtained in Table II are actual inputs per well, in some cases including the power consumption of other pump motors, which thus makes the average appear higher than the wells actually require.

The power consumption records include all power used at the well, not only for pumping, but also for pulling, bailing and cleaning, and include losses in transformers and lines owned by the consumer. The average is determined from the monthly kilowatt-hour consumption by assuming that the motors operated continuously. It will be appreciated that in selecting the high input of

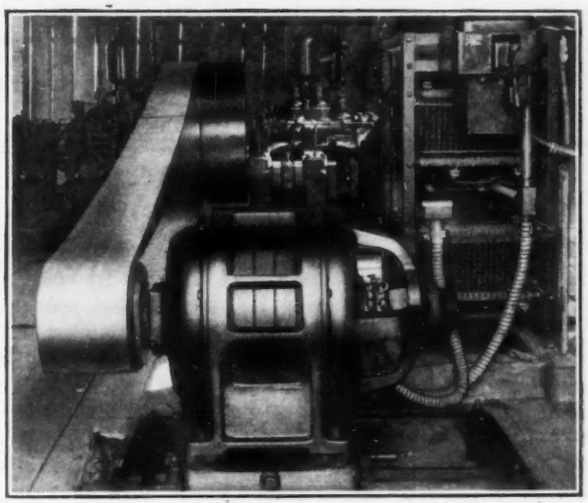


FIG. 5—MOTOR DRIVING SLUSH PUMPS FOR ROTARY DRILLING AT MONTEBELLO, CAL.

the Santa Maria, Casmalia and Cat Canyon fields as the basis for the comparison which has been made the motor has been heavily penalized. A more nearly correct average input would be about 4.75 kw., judging from the figures given in Table II.

The power rate used is the substation rate of the San Joaquin Light & Power Corporation in California, this being applied to any consumer who supplies all his transformers and necessary lines. The power company meters the input at one or more locations. This rate is not determined by the amount of power used, and an oil company with only one well could obtain it if desired. If the transformers and lines are not furnished by the oil company, the rate is 40 per cent higher, but the first cost of the installation is then reduced to $1,750 or $1,800, thus bringing down the fixed charges on the electrical equipment.

The question as to which rate is best to use can be readily worked out by any company, and it is found that the lower rate becomes more economical if about $600 worth of power per month is used. This corresponds roughly to a minimum of fourteen or fifteen wells. The minimum number would be less where the pumping load is heavy.

Power rates as well as power consumption vary considerably in fields in different parts of the country, and it can be readily appreciated that on this account, as well as because of the varying cost of gas and water for gas engines, individual comparisons must be made.

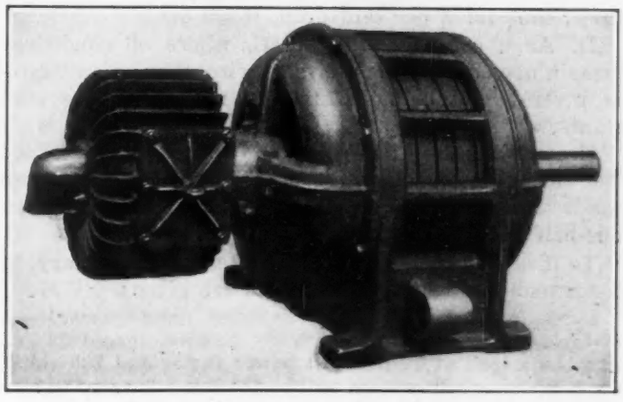


FIG. 6—IN GASEOUS OIL FIELDS THE SLIP RINGS ON MOTORS ARE INCLOSED

Calculating Distribution Lines

Rough-and-Ready Rule Applied to Ordinary Distribution Problems—Some Illustrative Examples for Distribution Circuits

BY AUSTIN BURT
Manager Citizens' Gas & Electric Company, Waterloo, Iowa

THE short-cut method for calculating line problems presented in the Aug. 27, 1921, issue of the ELECTRICAL WORLD, page 417, was adapted more especially to transmission lines. For distribution lines, on account of shorter distances, lower voltages and the more extensive use of single phase, it is desirable to modify the transmission-line method and make use of feet instead of miles and delivered volts divided by 100 instead of by 1,000. It is also advantageous to use 90 per cent power factor single phase with 1 per cent drop as a basis in place of 80 per cent power factor, three-phase, and 10 per cent drop.

The rule is based on the principle that for any given line in which the wire size and spacing remains unchanged there is a fairly definite line constant, w, for 90 per cent power factor and 1 per cent drop. This line constant, w, for single-phase, 60 cycles, and for wire sizes ranging from No. 6 to No. 4/0, is given by a simple formula, which can be easily memorized:

$$w = 300 - 30N - \tfrac{1}{2}S.$$

where N represents the number of the wire size and S represents the spacing in inches. Wire sizes No. 1/0 to 4/0 are negative and N is the number of naughts.

For illustration, take a No. 4 wire spaced 36 in.:

$$w = 300 - 30 \times 4 - \tfrac{1}{2} \times 36 = 162,$$

and a No. 4/0 wire spaced 28 in.:

$$w = 300 + 30 \times 4 - \tfrac{1}{2} \times 28 = 406.$$

The rule for distribution lines then is:

$$\text{Line kw.-ft.} = w \times (E \div 100)^2$$
$$= (300 - 30N - \tfrac{1}{2}S) \times (E \div 100)^2$$

where E represents the delivered volts.

The following points are to be noted in the use of the rule:

A. The rule is for single-phase. For two-phase and three-phase use, line constant $W = 2w$.

B. The line constant w is based on a load power factor of 90 per cent; for any other power factor, under 95 per cent, the line constant will be closely proportional to the given power factor; thus for 70 per cent power factor, $W = (70/90)\ w$.

C. The line constant w is based on 1 per cent drop, and it is directly proportional to any other per cent drop; thus for 8 per cent drop, $W = 8w$.

D. As a corollary to Note C, where all conditions remain unchanged except size of wire, the per cent drop is inversely proportional to the respective line constants, w.

E. In using the rule care should be used not to exceed the safe carrying capacity of the wire. As a rough guide the safe amperes are about 10 per cent more than one-half the line constant, w.

To illustrate the application of the rule under varying conditions the following examples are given:

Example 1.—To obtain kilowatt-feet (single-phase).—A 60-cycle, single-phase line with No. 2 wire, spaced 28 in., supplies a load at 90 per cent power factor and 230 volts; for a 1 per cent drop what will be the line kilowatt-feet?

$$w = 300 - 30 \times 2 - \tfrac{1}{2} \times 28 = 226,$$

and

$$\text{Line kw.-ft.} = 226 \times 2.3^2 = 1,195$$

Example 2.—To obtain load capacity for a fixed drop (single-phase).—If the line in Example 1 were 250 ft. long, with a 5 per cent drop, what load could be supplied at the end of the line?

By Note C, for 5 per cent drop:

$$w = 5 \times 226 = 1,130,$$

and

$$\text{Line kw.-ft.} = 1,130 \times 2.3^2 = 5,975.$$

Load = 5,975 ÷ 250 ft. = 23.9 kw. = 115 amp. Safe amp. = 125. (See note *E*.)

Example 3.—To obtain the line drop (three-phase).—Deliver 500 kw. at 80 per cent power factor and 2,100 volts, 60 cycles, three-phase, over a No. 4/0 line 3,000 ft. long with 40-in. spacing; what will be the per cent drop?

$$w = 300 + 30 \times 4 - \tfrac{1}{2} \times 40 = 400.$$

From Notes A and B, for three-phase and 80 per cent,

$$w = 2 \times 80/90 \times 400 = 712.$$

$$\text{Line kw.ft.} = 712 \times 21^2 = 314,000,$$
$$\text{Actual kw.-ft.} = 500 \times 3,000 = 1,500,000.$$

Percentage of drop = 1,500,000 ÷ 314,000 = 4.7 per cent. By accurate calculation = 4.9 per cent.

Example 4.—Drop if another wire size is substituted for that in Example 4.—In Example 3, if No. 2 wire were used instead of No. 4/0, what would be the per cent drop?

For No. 4/0, $w = 400$.

For No. 2, $w = 220 = 300 - 30 \times 2 - \tfrac{1}{2} \times 40$.

Therefore for a No. 2 wire, by Note D, percentage of drop = (400 ÷ 220) × 4.7 = 8.6 per cent. By accurate calculation = 8.8 per cent.

The rule affords a convenient means of determining the size of wire required for a given percentage of drop:

Example 5.—Size of conductor for given percentage of drop (single-phase).—A single-phase load of 60 kw. at 90 per cent power factor must be delivered at 230 volts, 60 cycles, over a line 164 ft. long with 44 in. spacing; for a 5 per cent drop what size wire will be required?

$W = 300 - 30N - \tfrac{1}{2} \times 44$ where N is unknown.

From Note C, for 5 per cent:

$$W = 5 \times (300 - 30N - 22).$$

$$\text{Actual kw.-ft.} = 60 \times 164 \text{ ft.} = 9,840 \text{ kw.-ft.}$$

Then, by rule:

$$5 \times (300 - 30N - 22) \times 2.3^2 = 9,840.$$
$$N = -3.1 = \text{No. } 3/0 \text{ wire.}$$

Accurate percentage of drop using No. 3/0 = 4.9 per cent.

Example 6.—Size of conductor for three-phase (Example 5).—If the load in Example 5 had been three-phase and 75 per cent power factor instead of single-phase, 90 per cent, what size wire would be required?

By Notes A, B and C, for three-phase, 75 per cent and 5 per cent:

$$W = 2 \times (75/90) \times 5 \times (300 - 30N - 22),$$

and by the rule:

$$5 \times 2 \times (75/90) \times (300 - 30N - 22) \times 2.3^2 = 9,840 \text{ kw.-ft.}$$
$$N = 1.8 = \text{No. } 2 \text{ wire.}$$

A very common problem is one where several loads are distributed at different points along a primary or secondary line. For this case the rule offers quite a simple means of finding approximately what the total percentage of drop will be.

Example 7.—Drop for variously spaced loads with one size and conductor spacing (single-phase).—Five single-phase lighting loads at 95 per cent power factor are distributed along a No. 4 wire primary line, with 28-in. spacing at the distances from the source as indicated; with 2,280 volts delivered at the last load what will be the per cent drop?

25 kw. × 2,400 ft. =	60,000 kw.-ft.
20 kw. × 3,000 ft. =	60,000 kw.-ft.
10 kw. × 4,200 ft. =	42,000 kw.-ft.
15 kw. × 4,800 ft. =	72,000 kw.-ft.
25 kw. × 6,000 ft. =	150,000 kw.-ft.
Total kw.-ft. =	384,000.

$$W = 300 - 30 \times 4 - \tfrac{1}{2} \times 28 = 166.$$

By Note B, for 95 per cent power-factor:

$$W = 95/90 \times 166 = 175.$$

By rule:

Line kw.-ft. = 175 × 22.8² = 91,000
Actual kw.-ft. = 384,000
Percentage of drop = 384,000 ÷ 91,000 = 4.3 per cent.
Accurate calculation = 4.1 per cent

Example 8.—Per cent drop with variously spaced loads and several sizes and spacings of conductors (three-phase).

Another problem that frequently happens is where several sizes and spacings of wire are found in the same stretch of line. In this case all that is necessary is to take "equivalent" lengths of one-size wire in place of the actual lengths of the different sizes and then apply the rule as usual. These equivalent lengths are found to be inversely proportional to the line constants, w, of the several sizes and spacings of wire.

A three-phase primary line is 15,000 ft. long and in two sections. The first section, nearest the source, is 7,000 ft. long equipped with No. 4 wire spaced 40 in.; the second section is 8,000 ft. long and equipped with No. 1/0 wire spaced 20 in. A load of 200 kw. is supplied at the end of the first section and 300 kw. at the end of the second section, both at 80 per cent power factor. If 4,100 volts is delivered at the last load, what will be the combined per cent drop?

W = 320, for the No. 1/0.
W = 160, for the No. 4.

and by inverse proportion:

(160 ÷ 320) × 8,000 ft. = 4,000 ft. of No. 4 at 40 in. equivalent to 8,000 ft. of No. 1/0 at 20 in.

Hence the equivalent No. 4 line will be:
7,000 + 4,000 = 11,000 ft. long, with 200 kw. 7,000 ft. from the source and 300 kw. 11,000 ft. from the source, or a total equivalent kw.-ft. of:

200 × 7,000 = 1,400,000
300 × 11,000 = 3,300,000

Total = 4,700,000

$W = 300 - 30 \times 4 - 20 = 160.$

By Notes A and B, three-phase and 80 per cent:

$W = 2 \times 80/90 \times 160 = 284,$

and by rule:

Line kw.-ft. = 284 × 41² = 478,000.

Percentage of drop = (4,700,000 ÷ 478,000) = 9.8 per cent, and accurate calculation in this case = 8.4 per cent.

Many other applications of the rule will suggest themselves to those who have much of this work to do.

In the article previously published in 1921, there is a typographical error on page 419 under the table for 25 cycles. The table should read as follows:

Size of Wire (No.)	
8	$W = 130 - 13 \times 8 = 26$
7	$= 130 - 14 \times 7 = 32$
6	$= 130 - 15 \times 6 = 40$
0	$= 130 - 15 \times 0 = 103$
00	$= 130 + 30 \times 1 = 160$
000	$= 130 + 30 \times 2 = 190$
0000	$= 130 + 30 \times 3 = 220$

Who Sells Electrical Appliances?—IV

A City of 250,000

"Electrical World" Survey of Retail Appliance Sales in a City Where the Central Station Sets the Pace and the Local Electrical League Has an Important Influence

RELATIONS between the electrical retailers of the three cities previously described in the *Electrical World's* survey of appliance sales varied from questionable competition and almost open strife to straightforward business methods which left no time for bickering and faultfinding. In this fourth city a happy combination of friendly competition and mutual support, promoted through the medium of an electrical league, was the outstanding feature. In choosing the cities for this investigation the *Electrical World* is giving chief consideration to geographic location covering the entire country and a wide range in population. It is not a "hand-picked" list intended to avoid certain situations and emphasize others.

CONTRASTED with the three cities already described, this one has but few tributary suburbs, its manufacturing plants are comparatively small, though well diversified, and much of the general business is of a wholesale and jobbing nature. The population is largely native-born white, and the city itself bears a reputation as a tourist resort which makes for a considerable number of transient visitors in the summer time. Electrically it has enjoyed a fairly high point of saturation for the last ten years, and much of the new business is derived from existing customers.

One of the interesting features of the appliance business in this city is the manner in which the electrical league is functioning. The association is made up of manufacturers, jobbers, contractor-dealers and the central-station company. There is a remarkable spirit of co-operation among the members, who have been most successful in getting together to put across promotional schemes for the general advancement of the industry. Like any similar organization, there is naturally a certain amount of dissension, but this comes from a relatively few contractors who have taken exception to some of the league's efforts toward raising the general standards of wiring. The league has been particularly successful in reducing price cutting among the contractors and has also been a strong influence in maintaining prices on electrical appliances.

There are four fair-sized hardware stores that might be considered as important outlets for electrical appliances. Their combined sales amount to less than 4 per cent of the total appliances sold in the city.

Dealer "A" is a first-class merchant doing a retail and jobbing business. The electrical appliance business is but a small part of the total sales, and as it is included with the cutlery department, it is impossible to give accurate figures as to profits. The sales manager thought that the department was conducted on a profitable basis and could not detect any losses that might be attributed to carrying an electric line. He foresees a good opportunity for the hardware dealer, but pointed out that there is a general lack of knowledge among the hardware men of the possibilities of electric appliances.

He was rather caustic in his criticism of the methods

of some electrical dealers. He figures that they are woefully lacking in energetic sales efforts, that their window dressing is extremely poor, that they fail to take advantage of the possibilities in demonstration, and that their merchandising business is, as he put it, "more luck than sense." He declared that all credit should be given to the central-station company for having developed a demand for electric appliances and its activity and advertising are a direct benefit to every other electrical retailer in the city. This hardware dealer did not feel that the power company was in any way trying to "hog" the business by offering long-term payments, as he looked upon this as another means of introducing appliances to the public.

Department stores, according to this dealer, have been rather bad competitors because of low-grade appliances which they have sold as specials. Not all have adopted this practice, but it has had the effect of giving all electric appliances a black eye and unstabilizing prices. In his opinion electric appliances have so far passed the experimental stage that they may well be classed as standard merchandise and should be carried in the regular stock of the retail hardware store.

Hardware dealer "B" carries a rather wide variety of appliances. For instance, there were on sale nine different makes of electric irons. There were also five different makes of toasters in stock and a number of hotplates and curling irons of indefinite origin. This dealer makes a practice of buying for cash in the open market, and approximately one-third of his electric appliance sales are from a stock purchased from a New York wholesaler who makes a specialty of importing German goods of all descriptions. Certain appliances are sold at reduced prices, but this is confined to the cheaper grades, and on well-known makes he maintains the usual list price.

The local central-station company had accomplished a great deal, he thought, in the introduction of household devices, but now that they had reached their present state of development, it would be just as well for the company to drop out of the business.

Hardware dealer "C" has only sold electric appliances for the past year. His stock, therefore, was comparatively new, and he has made it a point to carry only as much as is absolutely necessary. He had turned his investment approximately four times without, he said, particular effort. So far he has found it necessary to do very little servicing on the appliances and feels that electric appliances will grow into an important item in the hardware store.

This dealer makes a practice of carrying well-known makes of appliances and feels that it is a benefit to be able to assure customers of the high standard of his merchandise. He was not prepared, he said, to offer criticism of the methods of other electric dealers, and he thought the central-station company was performing a service for the dealers in exercising its policy of time payments and advertising electrical merchandise. He felt, he said, that it would be more to the benefit of every one concerned if it remained in the business than if it dropped out.

Hardware dealer "D" carries three well-known makes of appliances and some flatirons and toasters of cheaper grade. He does not sell either washing machines or vacuum cleaners, because, he said, they could be sold only on a deferred-payment basis and his was strictly a cash store. It is his policy to offer different appliances from time to time at reduced prices as leaders, and this practice is not confined by any means to non-standard makes, but whatever appears to meet the needs of an advertised leader is included. His electrical business for 1923, he said, was 50 per cent greater than that of

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY†

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Total Sales Each Class of Store	Per Cent of Total for City
Hardware Stores									
Store "A"	5	5	.....	275	150	40	60		
Store "B"	8	10	.....	50	30	18	15		
Store "C"	.....	.....	.....	250	75	50	50		
Store "D"	15	25	.....	200	80	60	36		
Total	28	40	.....	775	335	168	161		
Value	$3,500	$2,100	.....	$4,650	$1,507	$1,008	$1,932	$14,697	3.4
Per cent of electric appliance sales	23.8	14.3	.....	31.7	10.2	6.7	13.3		
Department Stores									
Store "E"	100	550	.....	300	325	75	50		
Store "F"	60	225	.....	350	300	75	30		
Store "G"	40	450	.....	400	650	120	75		
Store "H"	36	100	.....	250	125	100	80		
Total	236	1,325	.....	1,300	1,400	370	235		
Value	$29,500	$69,562	.....	$7,800	$6,300	$3,330	$2,820	$119,312	29.0
Per cent of electric appliance sales	24.8	58.3	.....	6.6	5.3	2.7	2.4		
Electrical Dealers									
Dealer "I"	33	114	.....	250	150	50	125		
Dealer "J"	7	18	.....	200	150	40	18		
Dealer "K"	40	115	.....	120	325	75	36		
Dealer "L"	15	36	.....	160	200	48	40		
Dealer "M"*	150	275	18	100	75	60	48		
Dealer "N"	18	50	.....	125	80	36	24		
Dealer "O"	24	48	.....	150	75	40	30		
Dealer "P"	.....	36	.....	120	150	48	30		
Dealer "Q"	10	15	.....	90	60	24	18		
Dealer "R"	.....	.....	.....	60	50	18	15		
Dealer "S"	20	125	.....	125	140	75	48		
Total	317	812	18	1,500	1,455	514	432		
Value	$39,625	$42,630	$2,700	$9,000	$6,647	$3,064	$5,184	$108,850	26.4
Per cent of electric appliance sales	36.4	39.2	2.4	8.3	6.1	2.8	4.8		
Central Station Company									
One company	409	1,378	61	2,754	500	1,100	975		
Value	$51,125	$72,345	$9,150	$16,524	$2,250	$6,600	$11,700	$169,694	41.2
Per cent of company's electric appliance sales	30.2	42.6	5.4	9.7	1.3	3.9	6.9		
Grand Total									
All dealers	1,090	3,555	79	6,329	3,790	2,552	1,803		
Value	$123,750	$186,637	$11,850	$37,974	$16,704	$14,002	$21,636	$412,553	100.0
Per cent of total sales	30.1	45.4	2.7	9.2	4.0	3.4	5.2	100.0	

* Factory branch store. † These figures represent sales for the last half of 1922 and first half of 1923. Date for 1923 alone would be 20 to 25 per cent greater.

1922, and he looks for a gradual increase from year to year. He was little concerned over the fact that some of the appliances which he carries would not give good service and pointed out that the customer knew he was buying a cheap device and could not expect it to give the same degree of service that he would get from a high-grade appliance. His purchases were made from both jobbers and manufacturers, depending upon whether the discount was suitable.

Department Stores

The general manager of store "E," who is also one of the owners, expressed himself as rather disgusted with the electrical appliance business. A little questioning brought out the fact that he had been through a trying experience with a washing-machine company whose failure is notorious throughout the industry. It appears that this store was caught with about five carloads of washers on its hands which have since been sold. There remains, however, an aftermath of servicing on these machines which has eaten up all profits. This man said that he had not yet solved the problem of selling washers on a money-making basis. He believed that the only way to is build up a large volume of business through an outside selling force. This he has found impossible because of inability to get reliable salesmen, and he criticised the electrical industry for having attracted or developed a type of house-to-house men of a most unstable and fly-by-night character. The vacuum cleaner, he said, was the only appliance upon which the store was realizing profit. This business is being conducted upon the resale plan.

Heating devices were carried largely to meet the demand of some customers. High-grade appliances made up most of the stock, although there were a few cheap stoves and curling irons. No profit came from this business, he said. This store owner was a strong booster for the central station and believed its advertising and pioneer work were valuable in building up a demand. He criticised the practice of one other department store in offering low-grade merchandise and also cutting prices on standard articles. This only tended to demoralize the business and bewilder the customer, who became skeptical of the real merit of a good device and doubted the value of appliances on which prices had been slashed.

Discounts, in this merchant's opinion, are too short, unless the dealer can purchase in large quantities. The "spread" does not allow of sufficient advertising and demonstrating nor the amount of servicing that appears to be a part of the electric appliance business.

A Merchant's Viewpoint

He summed up the situation thus: "When we can get responsible salesmen who know the business, when there is sufficient margin of profit to advertise and allow for reductions on slow-moving stock, and when either the appliances require less or the customers demand less servicing, then I believe that electric appliances will sell as any other merchandise."

At department store "F" the class of appliances carried was what might be termed "substandard" as the majority were of unfamiliar make. Curling irons were being offered for $1.10 each. An electric flatiron was on sale for $2.25, and there were a number of flimsy stoves on display at varying prices. This store had in stock some vacuum cleaners made by a reliable manufacturer, and these were sold regularly at about 5 per cent below the usual price. The same cleaner (selling regularly at $55) had been sold for $40 some time previously, when approximately 125 were sold.

It is the practice here to offer a cut price leader on some kind of merchandise at all times. Purchases are made frequently in "job lots" wherever the price is most attractive. Asked if discounts were sufficient, the manager said that they did not buy unless the price was right and they were able to make a profit on turning the goods. The sale of cheap and flimsy appliances is conducted solely on a *caveat emptor* basis and customers have little or no recourse when a device goes wrong. "Let them take it to an electrician or buy a new one," was the remedy suggested.

Department store "G" carries three makes of high-grade electric appliances, but specializes on one. This is done because of the value of the nationally advertised name and the belief that it is easier to push one brand than several. Washers and vacuum cleaners are handled on a resale agreement, and the manager is enthusiastic about the business, its profit, growth and future possibilities. Vacuum cleaners account for a large portion of total sales, but the other appliances move steadily the year round. Very little price cutting is indulged in. A repair and service department is maintained, and it is the policy of the store to satisfy customers on all legitimate complaints. A considerable amount of repair work is done, and the manager stated that a profit was realized from this business.

Discount, this manager stated, was a little short unless advantage was taken of maximum-quantity purchases. This question appears to be adjusting itself, and margins are now much better than two or three years ago. All purchases are made direct from manufacturers.

Department store "H" does no installment-payment business, consequently its sales of washing machines are small. A high-grade line of heating appliances is carried as a part of the house-furnishing department, although no particular effort is made to push sales. The department manager had no criticism to make of other electric dealers nor of the central station. The flood of cheap electric appliances now on the market should not be alarming, he pointed out, for the same condition prevails in other lines of merchandise, and the public soon learns to discriminate as to quality.

Contractor-Dealers

Electrical dealers generally are not established in the most active part of the shopping center, but, rather, have their stores on the outer rim. For the most part they are contractors whose principal business is wiring and fixtures. As a whole they do a considerable amount of repair work on appliances, and from observation their service in this respect is good.

Dealer "I" asserted that his appliance business is only a side line as the store's location is not favorable to merchandising and the firm's chief interest is in wiring. A fair amount of appliances are sold, however, on a cash basis. He characterized the central station as the backbone of the appliance business in the city and credited it with a great deal of promotion work. He doubted if the contractor-dealers would ever become a more important factor in appliance sales even if they had the best locations in town. Department stores had the choice locations—to a certain extent have created them—and also draw the crowds of shoppers. Their advertisements are always read by women and as a conse-

quence are more effective than those of the electrical dealer even though he use the same space. The result is that the advertising cost to the department store is lower per unit sold because of the volume of sales. With the advantages of location, larger crowds in a shopping frame of mind, more effective advertising and the natural tendency of the public to buy at the department stores, this dealer looks for their business to increase rapidly, while the electric store will be comparatively slow, with some abandoning appliance sales to specialize in contracting and fixtures.

Dealer "J" also stated that appliances are of secondary importance in his business and are carried largely to make a complete line. Profit is comparatively small and volume of sales does not warrant special effort. He felt that the central station was the logical outlet for appliances and that it was doing a good job.

Dealer "K" has probably the best location of any of the dealers. Wiring and fixtures are the important part of his business, but careful attention is given to appliance sales in the limited space, and approximately one-fourth of the total income is from merchandise sales. In his opinion an electric shop in the right location could be made to pay if conducted in conjunction with wiring and fixtures and if a sufficiently diversified line of merchandise were carried.

Dealer "M" is a factory branch store specializing on washing machines and vacuum cleaners. Heating devices are incidental. The manager here declared that the larger appliances could be sold only by outside effort and the branch store had been found the most satisfactory way of establishing a standard sales policy and training salesmen.

Dealer "N" also has a good location and does a very fair appliance business. For a store of this size a good amount of advertising is done, which is reflected in the volume of sales. With good advertising, an attractive store and alert salesmen, this dealer is making very little use of his windows. He criticised department stores for offering standard lines at cut prices as leaders, but could see no remedy except that electrical dealers should combine to refuse to purchase from jobbers or manufacturers who sold to department stores. This same attitude was expressed by other electrical dealers.

Five other contractor-dealers were all pretty much of the same opinion in praising the value of the local electrical league and the direct benefit of the central-station company's merchandising activity. The view was virtually unanimous that it would be detrimental to the total volume of appliance sales in the city were the company to retire from the field. The practice of a few drug-stores in selling a cheap grade of appliances seemed to trouble the dealers more than anything else because of the effect that using such appliances would have upon the public. It was not so much a question of competition as a desire to maintain a high reputation for the serviceability of appliances.

CENTRAL-STATION COMPANY

The central-station company has always been the leader in merchandising and has been a strong exponent of the policy that if it does not carry on the pioneer work of introducing new appliances nobody else will. The company now sells 41 per cent of all the appliances sold in the city, and the indications are that it can maintain this ratio for several years to come. Total sales for 1923 exceeded by about 25 per cent those of 1922, and the company contemplates increasing its selling force.

Co-operation in every way possible is given to dealers, department stores and hardware men by the central-station company. The company sets a high standard in the quality of merchandise, and while long-time payments are offered on the large appliances, other dealers are disinclined to criticise the practice. Those who do not offer such terms state that it is not their general policy to carry accounts over such long periods and they do not care to take business on that basis.

CONCLUSION

Allowing for omissions of some dealers and limiting the number of appliances under consideration to the seven leading items, the total yearly sales by all outlets will approximate $650,000 to $700,000. Of this total the central-station company is by far the greatest single outlet.

It is doubtful if many of the existing retail outlets will disappear from the field in the near future. Perhaps a few contractor-dealers may discontinue appliance selling in order to devote their entire attention to wiring and installation work. This will be offset among the contractors, however, by certain others who are inclined to enlarge their appliance business. The central-station company will certainly continue its activity in order to keep up standards and set the pace.

Among the hardware dealers there is a strong tendency to expand their electrical business because of its close relation to other household equipment. A natural demand has been built up, and as the margin of profit is fairly attractive it is a desirable line for the hardware store. These stores will become a more important factor each year.

Department stores, with possibly one exception, are definitely committed to handling electrical appliances. They are convinced that they are well past the experimental stage and the demand is sufficiently voluntary to necessitate little or no development work on their part.

From the foregoing it is apparent that both hardware and department stores will increase their appliance activities at a much faster rate than will the contractor-dealers. It naturally follows that their sales will become a larger proportion of the total. This does not mean that the contractor-dealers' sales will necessarily decrease, but relatively they will be a smaller part of the total.

Sales are divided approximately as follows: Hardware stores, 3.4 per cent; department stores, 29 per cent; electrical dealers, 26.4 per cent; central station, 41.2 per cent. Without doubt the total volume will continue to increase, but at the end of three to five years there will be a certain change in the percentage, and, based on the trend of the last three years, the following may approximately represent the distribution of sales: Hardware stores, 5 per cent; department stores, 32 per cent; electrical dealers, 20 per cent; central station, 42 per cent; miscellaneous non-electric dealers, drug stores, etc., 1 per cent.

This estimate is based upon the assumption that the change will be gradual, which seems probable because of the unity among electrical men. It may be more rapid, however, and if so sales will gravitate toward the department and hardware stores and probably away from dealers more than from the central station. Sales by miscellaneous stores will hardly increase beyond the above figure and may show a decrease as much of their business is upon a consignment basis and is far from substantial.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Proposes Classification of Harmonics as "Triplen" and "Non-triplen"

To the Editors of the ELECTRICAL WORLD:

It is well known that three kinds of higher harmonics may be distinguished in a three-phase system. These are:

1. Harmonics of the order 3, 9, 15, 21, 27, 33, etc., which are in phase with one another in all the three phases. Harmonic voltages of these orders produce an oscillating neutral; the corresponding currents flow between the ground connections or through delta windings. Currents of these orders produce a pulsating, and not a revolving, magnetic field in three-phase armature windings.

2. Harmonics of the order 5, 11, 17, 23, 29, 35, etc., each of which forms a three-phase system by itself, superimposed upon that due to the fundamental voltages and currents. The phase sequence of these harmonics is opposite to that of the fundamental voltages, so that if the revolving magnetic field due to the fundamental currents rotates clockwise, that due to the fifth harmonics rotates counter-clockwise.

3. Harmonics of the order 7, 13, 19, 25, 31, 37, etc., each of which forms a three-phase system of the same phase sequence as the fundamental voltages and produces a revolving field in the same direction as that due to the fundamental currents.*

While recently writing for a book a chapter on higher harmonics in the three-phase system, I was confronted with the necessity for an abbreviated nomenclature for these three kinds of harmonics, to avoid using a descriptive phrase every time one of them is mentioned. I was told that there were no recognized terms in mathematics to signify "multiple of three" and "not multiple of three," to correspond to the words "odd" and "even." So I asked one of my colleagues, C. L. Durham, professor of Latin, to coin a suitable word which would be internationally understood. He suggested the words " triplen" and "non-triplen," which can be used either as adjectives or as nouns. The word "triplen" means "one which contains an integer n three times"—in other words, an integer of the form $3n$.

On the same basis the words "quadruplen," "quintuplen," etc., and "multiplen" could be used for technical purposes†

The advantage of the foregoing terms is that they can be generally used in mathematical problems, aside from polyphase systems. One may speak, for example, of the convenience of having dimensions in drawings in quadruplen numbers, or of retail prices of articles in quintuplen numbers.

An alternate proposal is to use the term "monophase" (or "uniphase") for harmonics multiple of three, since they are all in time phase with each other, and to use the term "polyphase" for the remaining harmonics. It is also possible to distinguish the three groups of harmonics according to their phase sequence.

It may be too early yet to standardize on any notation, but undoubtedly the importance of higher harmonics in polyphase systems will be on the increase for some years to come, and the foregoing suggestions are made in the hope that they may be of assistance to those who have to speak or write on the subject.

VLADIMIR KARAPETOFF.

Cornell University, Ithaca, N. Y.

*See V. Karapetoff, "The Magnetic Circuit" (McGraw-Hill), page 136.

†The words "threesome," "foursome," etc., have also been suggested, but since such endings have already been appropriated for a much more important purpose, it has been decided to steer clear of them.

Why Some Contractors Quit Selling Appliances

To the Editors of the ELECTRICAL WORLD:

In one of your articles, "Who Sells Electrical Appliances?" it is stated that in a city of 500,000 some fifteen contractor-dealers had failed in the last three years. The causes of those failures are enumerated as lack of merchandising sense on the part of the contractor-dealer, too short discounts, price cutting and competition from factory branch and specialty stores. While agreeing that all those factors surely were contributing causes, it strikes me, as a contractor-dealer, that a little further explanation of what was back of those failures would be desirable.

About four years ago, if I remember correctly, there was a nation-wide movement, sponsored largely by manufacturers and jobbers, urging contractors to increase their sales of appliances. Glowing possibilities of handsome profits were held forth, and it was hinted that central-station companies would retrench in their merchandising departments. So, having enjoyed the easy profits of the war-time "sellers' market," many contractors "fell for" the scheme. What happened late in 1920 and in 1921 hardly needs repeating.

When depression came manufacturers and jobbers forgot the contractor-dealers in their scramble to find outlets for their stocks. Appliances were sold to whomsoever would buy, and discounts that had never been dreamed of by the contractor-dealers were offered to large purchasers. The dealers were left high and dry, many with large stocks on hand in a falling market. Not only did they have to meet new competition from non-electric stores favored by better discounts, but some manufacturers further complicated the situation by establishing retail stores of their own. In view of those conditions, it is not much wonder that many of the contractor-dealers "dropped by the wayside."

This matter of discounts has long been a thorn in the side of the contractor. The fact that the department stores buy direct from manufacturers has been mentioned several times in your articles. By so doing they secure the jobbers' discount of about 50 per cent. On the other hand, the average contractor must buy from the jobber at discounts of only 30 to 37.5 per cent and maybe 40 per cent in rare instances. Why is it that manufacturers who urge the contractor to engage in the appliance business will turn around and sell direct to his keenest competitor at maximum discounts and at the same time force the contractor to buy through a jobber?

J. C. KINCAID.

[The ELECTRICAL WORLD is not unmindful of the apparent discrepency between discounts extended to dealers of different classes. When the series of articles has been completed a composite analysis will be made, and, among other things, the matter of discounts will be discussed.—EDITORS.]

Maintenance Schedule of Texas Company

Covers Buildings and Yards, High-Tension and Low-Tension Apparatus and Transmission Lines—Details of System and Method of Applying Will Be Given

GOOD operating results are dependent on the ability of an operating force to find and remove the causes of trouble before the trouble actually occurs. Equipment that is housed in a generating station or an attended substation is comparatively easy to watch because some one is on hand constantly to see that it is kept in operation. The problem is a more difficult one in the case of transmission lines that must be stretched over large areas and are in position where the vagaries of climate make the physical job of watching them even more difficult. To solve these problems a rather interesting form of maintenance schedule has been adopted by the Texas Power & Light Company of Dallas.

In the application of this schedule the first step is the organization of the maintenance forces so that there shall be divisions of a size that can be properly handled by the men who are made responsible for each division. Each district should be under the supervision of a responsible head to whom are assigned sufficient patrolmen to cover the lines properly. The second step is a carefully laid-out maintenance schedule. The Texas Power & Light Company first decided on the inspections that should be made on each piece of high-tension and low-tension apparatus in the transmission line and substations that are a part of the transmission system. These inspections, which will be outlined in later articles, were grouped according to classes of equipment and then arbitrarily numbered in consecutive order. A 5-in. x 8-in. card was made out for each inspection and the details and serial number of each inspection were set down. These cards were made out for each division and filed in the division chief's office. The information was also put on 4½-in. x 6-in. loose-leaf sheets and bound in a loose-leaf binder so that each patrolman could have the information to carry in his pocket. Based prin-

Form 1256—1M—12-19

Power Dept. **MAINTENANCE OF EQUIPMENT** Inspection No._____

Transmission System

Form 1257—1M—12-19

MAINTENANCE OF EQUIPMENT

_____ District **TRANSMISSION SYSTEM** _____ Week

STATION	Section	Insp	STATION	Section	Insp	Station	Section	Insp	Station	Section	Insp.

FORTY EIGHTH WEEK INSPECTION REPORT FOR MCKINNEY DISTRICT

November 26,1923
Earl Apperson - Patrolman

JENKINS

73

75

MCKINNEY SUBSTATION

73

75

MCKINNEY PLANT

31

32

73

75

INSPECTION NUMBERS	1923 DATE	COMMERCE TWO WEEK INSPECTIONS	WEEK
1	1-4	Cut grass + weeds in substation yard	1st
4	1-4	Clean transformer foundations	1st
8	1-4	Swept + dusted out switch house	1st
45	1-19	Tested bell alarms and found OK	2nd
1	1-20	Cleaned up substation yard	2nd
4	1-20	Cleaned oil foundations	2nd
8	1-20	Swept + dusted building	2nd
45	1-24	Bell alarms are OK	4th

PROPER MAINTENANCE IS OBTAINED ONLY BY THOROUGH SCHEDULED INSPECTION

Left, top—Details for conducting each scheduled inspection filed by serial number. One set of 5-in. x 8-in. cards is kept in division chief's office and similar information is kept by each patrolman in loose-leaf notebook classified by serial number.

Left, center—Tickler card (5 in. x 8 in.) for scheduled inspections.

Right, top—Form of order (8½ in. x 11 in.) for weekly inspections mailed to respective patrolmen each week. Numbers refer to inspection to be performed. Space is provided for conditions found and any comments required.

Bottom—Maintenance ledger (12 in. x 14 in.) posted from patrolmen's reports and divided into sections corresponding to stations, lines and districts.

cipally on the cost and the possibility of service interruptions, a schedule of the frequency of each inspection was made up. Operating experience gave the necessary information on which to make these determinations.

Each patrol district was then considered, and the inspections were grouped so that the travel would be minimized. It was necessary that annual inspections should be arranged at such times as the load conditions would permit. With these determinations made it was then possible to make up a tickler file from which the division chief could determine at a glance the amount of work to be done in each of the fifty-two weeks of the year.

In making up the weekly schedules only the inspection numbers are set down as the men have the details of each inspection in their books and can turn to them for the information. On Friday of each week the chief clerk in the office of the division chief picks out all the inspection cards for the following week and makes out an 8½-in. x 11-in. sheet for each station or line for each patrol district. These are mailed to the respective patrol or repair men, who perform the duties allotted and report, in the space provided on each sheet, the conditions found, the repairs or adjustments that were made and any observations that are thought of interest. Any inspections that could not be made are noted and carried forward into succeeding weeks until cared for.

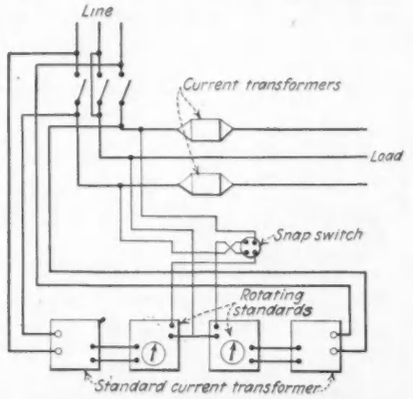
At the close of the week the record sheets are mailed back to the division chief's office, where the information is entered in the maintenance ledger, which consists of a loose-leaf book with 12-in. x 14-in. sheets divided into sections corresponding to the various stations or lines in each patrol district and with sufficient sheets to permit grouping of each inspection so that there shall be a complete history of what has been done to each piece of apparatus under the various inspections. The real success of the system is dependent on prompt execution of all inspections, conscientious, thorough and intelligent carrying out of the work and reports in detail of everything found.

As laid out for the Texas Power & Light Company, the maintenance schedule covers four main divisions, which are (a) buildings and yards, (b) high-tension apparatus, (c) low-tension apparatus, and (d) transmission lines. The detail schedule is of interest to operators who have these problems to meet, even though the conditions on this property may make necessary some changes in the details if such a schedule be applied to another property. The detailed inspection provided for under each of these heads will be presented in succeeding issues of the ELECTRICAL WORLD.

Testing Polyphase Meters in the Field

BY F. E. HOWELL
Foreman Meter Department, Midland Counties Public Service Corporation, Santa Maria, Cal.

THERE have been several articles in the ELECTRICAL WORLD describing methods of combining rotating standard wattmeters with variable-load instruments for convenience in testing single-phase meters. This company has been using a similar equipment for the past four years with very satisfactory results. Recently we have enlarged upon this idea in order to obtain the same efficiency and convenience in testing polyphase installations.

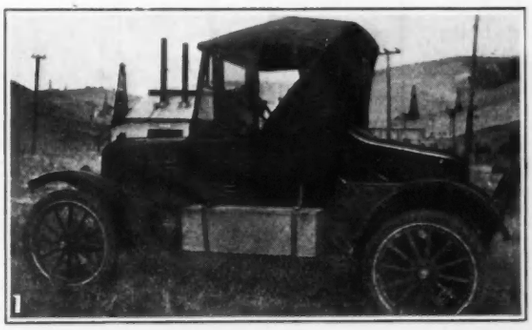


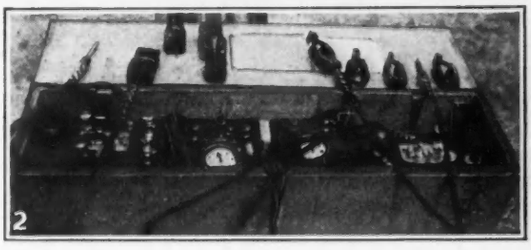
Two single-phase rotating standards and two multi-ratio current transformers were installed in a box, with leads permanently attached to the instruments and one snap switch controlling both standards, as shown in the accompanying illustrations. By connecting the primary leads of the standard current transformers to each side of the service switch, with a jumper around the third blade, the switch may be opened, throwing the test equipment in series with the consumer's metering equipment. This procedure has been found very satisfactory where the consumer's load is used for testing. Test receptacles may be installed on each switch to receive the plug on the ends of the test leads.

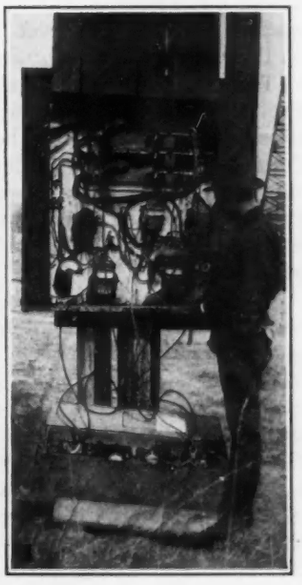
Removing and Preventing Rust in Penstocks

BY GEORGE H. BRAGG
Engineer of Maintenance Pacific Gas & Electric Company, San Francisco

WHEN an exposed steel structure shows evidence of deterioration due to rust, the surface should be cleaned before a protective coating is applied, because experience has demonstrated that the most effective paint would be wasted and the labor to apply it would be lost if this precaution should be overlooked. Hence, when rust barnacles of extraordinary size and pits of unusual depth were found in a penstock on the system of the Pacific Gas & Electric Company after a comparatively few years of service, there was only one course to pursue to stop the action and pre-







COMPACT APPARATUS FOR CONDUCTING FIELD TESTS

CLEANING PENSTOCKS BY SAND BLAST

Length of pipe cleaned and painted per eight-hour shift, ft.	25
Area of pipe cleaned and painted per eight-hour shift, sq.ft.	550
Velocity of draft of air in penstock, ft. per minute	6
Air pressure at machine, lb. per square inch	100
Quantity of air per nozzle, cu.ft. per minute	100
Weight of sand per square foot of pipe cleaned, lb.	5 to 7

serve the strength of the pipe. This penstock is fabricated of steel plates, varying in thickness from $\frac{5}{16}$ in. to $\frac{3}{4}$ in., rolled and riveted together, making a pipe varying in diameter from 7 ft. at the upper end to 4½ ft. at the lower end, the total length being 6,700 ft. It furnishes water to the Wise power house, which has a capacity of 12,500 kva. under a head of about 500 ft.

The sand blast was adopted as the best method to clean the pipe. The direction of the natural draft in the pipe was usually from the lower to the higher elevations. This was augmented by fans which prevented a reversal and caused the air to move at the rate of approximately 6 ft. per minute. Wooden bulkheads were placed in the pipe at the knolls or highest points in the profile to permit simultaneous operations by several crews without handicapping each other.

The sand-blast machines were taken inside the pipe and placed close to the working area, it having been found that the best results were obtained when 50 ft. of hose to the nozzles was not exceeded. The air supply was conveyed from the compressors by means of a line of screwed pipe laid parallel to the penstock, thence by a rubber hose inserted through the rivet-pass holes in the penstock to machines inside.

The machines were placed under the holes and the sand was poured directly into them with the aid of a funnel. After being discharged the mixture of rust and sand was scooped into the machine and blown outside through the nozzles inserted in the rivet-pass holes.

The best efficiency and progress was made when two eight-hour shifts were employed consecutively to sand-blast, after which the third shift cleaned up, moved the equipment ahead and put it in order for use by the next shift. Meanwhile the painters followed at the same rate, always keeping within 50 ft. to 100 ft. from the sand-blasters. Under the rigid inspections maintained the conditions given in the above table were present.

Graded Monterey beach sand from a silica formation was used throughout the job.

After due consideration of the merits of the various protective coatings on the market, it was decided to apply two coats of red lead by means of bristle brushes. The paste was carefully mixed in the following proportions: 100 lb. red-lead paste and 2 gal. boiled linseed oil. Just before using there were added 5 lb. litharge and 2 quarts boiled linseed oil.

The first coat was allowed to dry and harden for one week before the second coat was applied. After applying the first coat an inspection of the work indicated that the material was not reaching the deeper pits in the metal, in spite of the fact that great care was used in brushing. It was concluded that air was being pocketed under the film of paint, which later expanded and burst through, leaving a minute area of metal exposed. The difficulty was corrected by going over the work after a lapse of one hour and "touching" all places not covered.

When the work was about 50 per cent complete it became evident that the painting progress was not keeping pace with the sand-blasting. Air brushes were therefore substituted for the hand brushes and, as might be anticipated, proved considerably faster, although there was a greater tendency for the red lead to separate from the oil and "run." This difficulty was corrected by hand brushing after the paint was partly set.

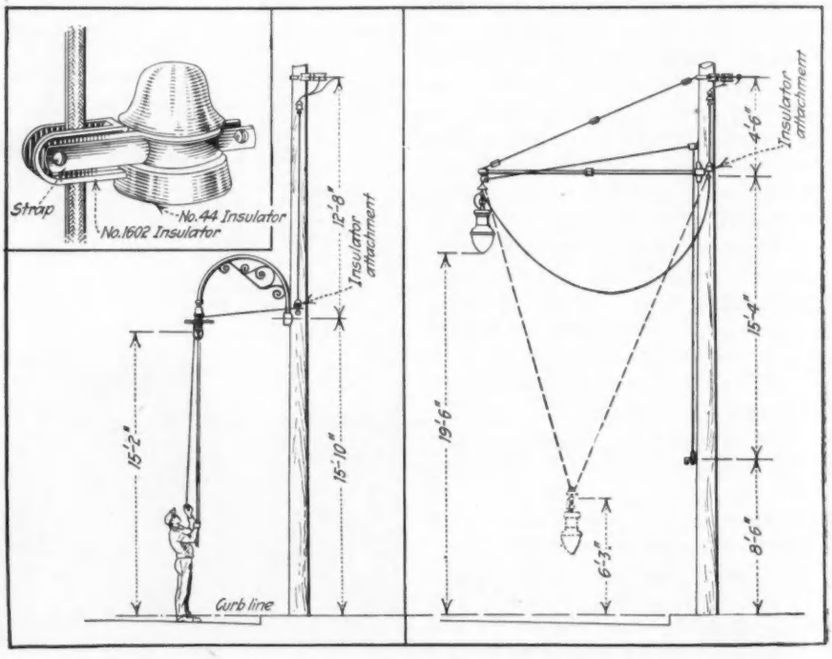
Although the work was carried on in January and February, the temperature inside the pipe ranged from 48 deg. F. to 110 deg. F., the higher temperature coming during the day. It was found that the fumes from the paint created by the heat was more or less objectionable to the workmen and necessitated that the application be confined to the cooler weather during the night period.

Aside from prolonging the life of the pipe, the restoration of a smooth surface for the flow of the water reduced the friction losses in the pipe by 25 per cent and increased the total effective head at the power house by approximately 3 per cent.

Special Insulator Used for Street-Light Drops

BY R. A. HAMMOCK
Superintendent of Electrical Distribution, Public Service Company of Colorado, Denver

OWING to the trouble experienced from arc-light drop wires crystallizing and breaking when rigidly tied the special insulator attachment shown in the accompanying illustration was developed by the Public Service Company of Colorado. The attachment consists of a piece of slotted porcelain held to a standard pin-type insulator by metal straps. This alows the street-lighting drop wire to hang free, and as it swings in the wind it bends over a large



INSULATOR ATTACHMENT ALLOWS STREET-LIGHTING DROP TO SWING FREE AND PREVENTS BREAKING

enough radius to prevent breaking the wire.

Since the adoption of this device no trouble has been experienced with open circuits from the breaking of the duplex drop at the lower insulator. The attachment is also used for transformer risers instead of a pin and insulator or a bracket and insulator. In this case a tie wire is used to make a permanent fastening. The device is now made by one of the large line hardware manufacturers.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Reinforcing and Identifying Distribution Poles

Reinforcing.—Poles which have decayed beyond the allowable amount, the upper portion being sound, should be reinforced wherever feasible. However, poles shall be reset rather than reinforced if they may be lowered and still give sufficient clearance and proper grading of the line. In municipalities the unsightly appearance of stubs may prevent their use except in alleys or similar locations.

The method shown in Fig. 5 will normally be used, alternating the stubs to the right and left side of the lead. The construction shown in Fig. 6 will normally be used when it is necessary to place the stub in line with the lead. In these methods the butt of the pole in the ground acts as a support for the stub. It is therefore necessary to make sure that the butt is sound and, from the nature of the rot in adjacent poles, is likely to remain sound so as to give suitable bearing to the pole.

The method shown in Fig. 7 is an alternate to the method shown in Fig. 5 and provides for removing the old butt and placing the stub in the old hole. Fig. 8 is an alternate for Fig. 6 and provides for removing the old butt and placing the stub in the old hole.

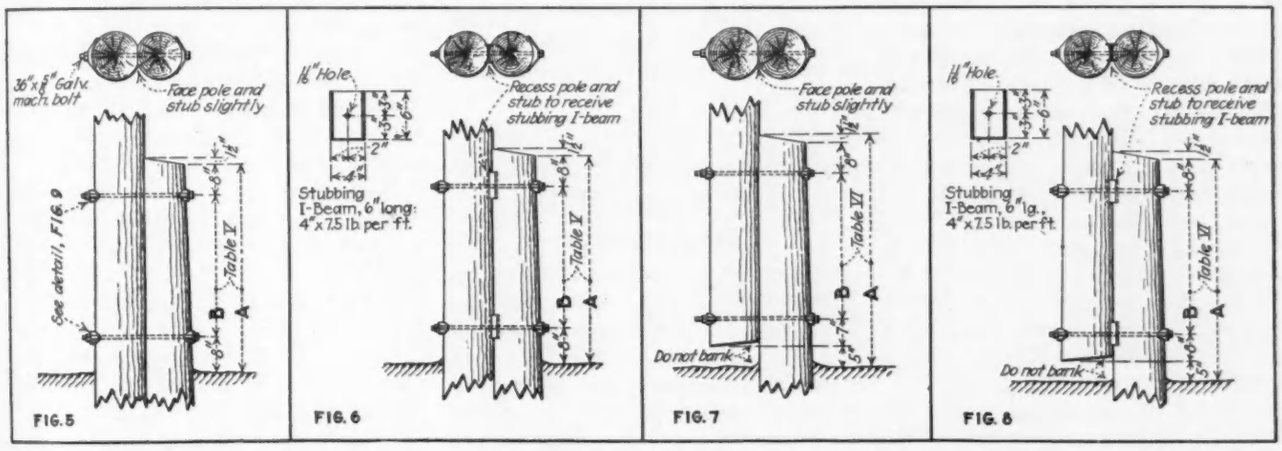
Figs. 7 and 8 should be used whenever the excavation of stub hole adjacent to the pole would be difficult, as in rock, or when the butt of the pole will not give a firm bearing to the stub. They should also be used when the pole is nearly or entirely rotted off and where the decay extends to an appreciable distance above the ground line and is liable to weaken the pole where the fastenings are applied.

Handling of Pole and Stub.—Always see that all soft or decayed wood is removed from the pole, including outside brittle layers of sapwood. In case it is impracticable to remove the stub by the methods shown in Figs. 7 and 8, saw off the old pole below the ground line and cover it over with earth. Before setting the new stub trim off the sides of the hole and remove all loose earth and rotted wood. Do not use such earth for filling the hole, as the fungus causing the rot is present in this earth and will accelerate decay. Face the pole at the bottom and the stub at the pole slightly to insure good contact between the pole and the stub, and if necessary at the reinforcing washers. The details of the reinforcing washers are shown in Fig. 9. Jam all threads projecting beyond nuts after bolts have been thoroughly tightened.

Identification.—Poles shall be identified by means of a copper disk 2¼ in. in diameter countersunk into the pole ⅜ in. The location of the disk shall be on the face of the pole 7 ft. above the ground line. These disks will be attached to the pole by means of a dating nail driven through the hole in the center of the disk. The dating nail is to bear the last two figures of the year in which the pole is set.

New poles shall be identified as above upon being set; old poles will be identified by special screws for that purpose. When a pole is reset the old dating nail and disk will be moved, so that its position shall be again 7 ft. from the ground line. An additional dating nail will be driven 3 in. below the disk the year a pole is reset or reinforced.

Attachments.—No attachments on foreign or affiliated poles shall be made until proper approval is obtained. Likewise, no foreign attachments on the company's poles shall be allowed except with prior approval. All agreements as to attachments shall be in writing and receive approval of the right-of-way department.


36"x⅝" Galv. mach. bolt
Face pole and stub slightly
See detail, FIG. 9
Table V
FIG. 5
⅛" Hole
Recess pole and stub to receive stubbing I-beam
Stubbing I-Beam, 6" long 4"x7.5 lb. per ft.
FIG. 6
Face pole and stub slightly
Do not bank
FIG. 7
⅛" Hole
Recess pole and stub to receive stubbing I-beam
Stubbing I-Beam, 6" lg., 4"x7.5 lb. per ft.
Do not bank
FIG. 8

FIGS. 5 TO 8—FOUR METHODS OF REINFORCING DISTRIBUTION POLES

TABLE V—DIMENSIONS OF STUBS FOR REINFORCING POLES (FIGS. 5 AND 6)

Length of Pole, Ft.	Distance A Ft.	Distance A In.	Distance B Ft.	Distance B In.	Minimum Total Length of Stub Ft.	Minimum Total Length of Stub In.	Minimum Diameter of Stub In.
30	4	4	3	0	9	10	8
35	4	4	3	0	10	4	9
40	4	10	3	6	10	10	10
45	5	4	4	0	11	10	11
50	5	10	4	6	12	10	12½

Material for Stubs.—Stubs shall be made from (a) sound new chestnut cut for that purpose, (b) sound chestnut or cedar cut from new poles, or (c) sound chestnut or cedar cut from old poles in exceptionally good condition. All stubs shall be brush-treated for their full length with the treatment required for poles. The circumference at the ground line of all stubs shall be not less than that required for a new pole of the same material as the stub. Stubs shall be set to the same depth as required for a new pole of the height of the pole to be reinforced.

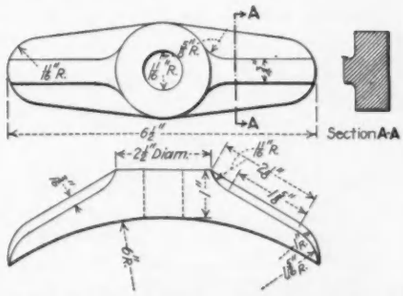
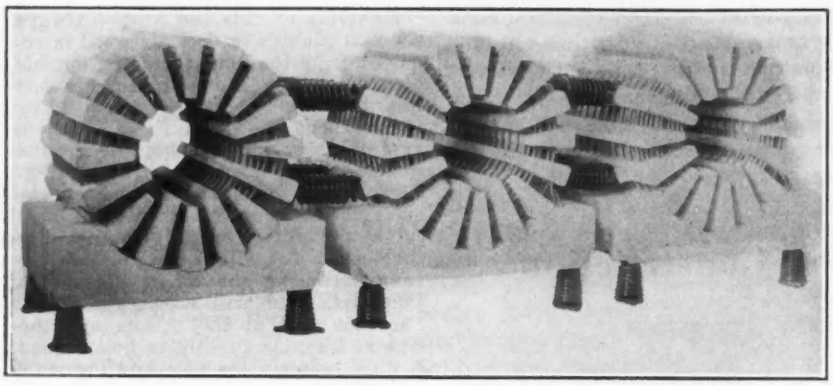


FIG. 9—STANDARD CAST-IRON-GALVANIZED-POLE REINFORCING WASHER

TABLE VI—DIMENSIONS OF STUBS FOR REINFORCING POLES (FIGS. 7 AND 8)

Length of Pole, Ft.	Distance A Ft.	Distance A In.	Distance B Ft.	Distance B In.	Minimum Total Length of Stub Ft.	Minimum Total Length of Stub In.	Minimum Diameter of Stub In.
30	4	8	3	0	10	2	8
35	4	8	3	0	10	8	9
40	5	2	3	6	11	2	10
45	5	8	4	0	12	2	11
50	6	2	4	6	13	2	12½



ASSEMBLING CURRENT-LIMITING REACTORS WITH LONGITUDINAL AXIS HORIZONTAL

Horizontal Reactors for Limited Space

BY F. H. KIERSTEAD
Engineer General Electric Company, Pittsfield (Mass.) Works

VERY often in power stations the space available for installing current-limiting reactors is quite small in width, while the height and depth are greater. This occurs when the reactors must occupy cells with the same width as switch and regulator cells. In such cases space is economized by assembling the reactors with their longitudinal axis horizontal. The reason for this is that the lengthwise dimension of the reactor can be made small if the diameter is made large. Such a reactor is assembled with its lengthwise dimension in the direction of the width of the space, while the diameter dimensions extend in the direction of the depth and height.

The base required for the horizontal type of reactor is somewhat difficult to manufacture and therefore may be more expensive than the base used with reactors in which the axis is vertical. Furthermore, the number of concrete pillars which support the conductors increase as the diameter increases. For these two reasons, therefore, horizontal-type reactors may be more expensive than the vertical type, in spite of the fact that the former can easily be built with a shape that is more economical of copper and losses than the latter.

Instruments Used by Central Station Meter Department

FOLLOWING a liberal policy as to the purchase of instruments and equipment for meter department use, the Worcester (Mass.) Electric Light Company maintains the equipment given in the accompanying table. This company serves a population of approximately 200,000, the total number of customers on the system at the beginning of the present year being 39,567 and the total number of meters, including 392 demand indicators being 40,902.

Advantages and Limitations of Coal Storage

ANY system of cranes, drag scrapers, conveyors or trestles utilized in a coal-storage plant should be measured by comparing its limitations and advantages with the items given below, according to the views expressed by H. E. Burch and H. V. Coes in a paper presented at the recent annual meeting of the A. S. M. E.

1. It must be of such design that it can be easily extended both as to ground covered and hourly capacity to take care of any future requirements called for.

2. It must meet the operating maintenance and interest formula. Do not base the ton cost of handling and reclaiming the coal on the annual coal consumption, as all coal consumed may not be stored but may be used directly.

3. Boats or railroad cars must be unloaded rapidly and economically.

4. Coal should be stored in such a manner that spontaneous combustion is prevented.

5. It must be a system that can reclaim the coal economically and one which can quickly and easily fight fire.

6. The system should be flexible enough to allow for future extensions and should not block growth of the plant. It should be mobile enough to adapt itself readily to an entirely new location.

7. The trackage facilities should be laid out to handle the coal traffic properly without interrupting the general plant traffic. Provide gravity facilities if possible for handling cars over the track hopper.

TEST INSTRUMENTS OF THE WORCESTER ELECTRIC LIGHT COMPANY METER DEPARTMENT

- 1 Westinghouse precision wattmeter (0.5 and 5-amp. coils)
- 1 Westinghouse precision wattmeter (5, 20 and 100-amp. coils)
- 1 Westinghouse precision voltmeter
- 1 Westinghouse precision 10-amp. ammeter
- 1 Westinghouse precision 6,000-omh resistance.
- 1 Leeds & Northrup potentiometer, type K
- 3 Weston standard cells
- 1 100-amp. shunt
- 1 15-amp. shunt
- 1 galvanometer
- 1 volt box
- 1 call bracket
- 1 right-angle prism attachment
- 1 angle minor
- 1 variable resistance
- 1 Silsbee current transformer testing set
- 1 Silsbee potential transformer testing set
- 1 phase shifter
- 1 phase sequence indicator
- 1 duct temperature indicator
- 1 Leeds & Northrup illuminometer and sphere
- 1 Spencer binocular microscope
- 1 2,000-megohm megger
- 1 Weston milliameter
- 3 States Co. meter-testing boards
- 1 special test board
- 2 G.E. type IB rotating standards
- 7 G.E. type IB-6 rotating standards
- 3 multipliers
- 1 Westinghouse single-phase rotating standard
- 1 Westinghouse three-phase rotating standard
- 2 Mowbray rotating standards
- 2 Sangamo rotating standards
- 1 Thompson 100-amp. A.C. ammeter
- 1 Thompson 50-amp. A.C. ammeter
- 1 Thompson 15-amp. A.C. ammeter
- 2 Thompson 5-amp. A.C. ammeters
- 1 Weston 100-amp. D.C. ammeter
- 1 Weston 15-amp. D.C. ammeter
- 1 Weston 300/600-volt A.C.-D.C. voltmeter
- 1 Weston 150/300-volt A.C.-D.C. voltmeter
- 1 G.E. 150/300-volt A.C.-D.C. voltmeter
- 1 G.E. 15-volt A.C. voltmeter
- 2 G.E. 600-volt D.C. voltmeters
- 1 G.E. 15/150-volt D.C. voltmeter
- 1 G.E. 1.5/15/150-volt D.C. voltmeter
- 1 G.E. 150-volt D.C. voltmeter
- 1 Westinghouse ammeter, 1 and 2 amp.
- 1 25-200 amp., 300/600-volt wattmeter
- 1 Y-box for same
- 1 3-amp., 150-volt wattmeter
- 2 2-amp., 150-volt wattmeters
- 1 75-amp., 150-volt wattmeter
- 3 15-amp., 150-volt wattmeters (with multipliers)
- 1 50-amp., 150-volt wattmeter
- 1 20/40, 300/600-volt three-phase wattmeter
- 1 10-amp., 150-volt wattmeter
- 1 200-amp., 150-volt wattmeter
- 1 Graphic tachometer with generator
- 1 Westinghouse cycle counter
- 2 G.E. standard current transformers
- 1 Westinghouse standard potential transformer
- 2 Steam-engine indicators
- 6 Westinghouse graphic ammeters
- 8 Westinghouse graphic voltmeters
- 4 125-amp. Splitcore current transformers
- 4 250-amp. Splitcore current transformers
- 2 500-amp. Splitcore current transformers
- 1 1,000-amp. Splitcore current transformer
- 11 States Co. phantom loads, 35-amp., 110/220 volts
- 2 States Co. phantom loads, 75 amp., 550 volts
- 1 States Co. phantom loads, 150 amp., 110/220 volts
- 1 States Co. phantom loads, 300 amp., 110/220/550 volts
- 1 States Co. phantom loads for relay testing

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Electric Domestic Science in School Pays Own Way

AN EXCEPTIONALLY interesting use of the home economic department of the high school of Edgerton, Wis., is being made whereby instruction in electric cooking is being given and at the same time the cost of the electrical equipment of the department is being paid for. All cooking operations are done electrically, and energy is furnished from the lines of the Janesville (Wis.) Electric Company.

The town of Edgerton has a population of about four thousand people, and the high school's department of domestic science has been developed into something of a community affair. It has taken charge of nearly all the banquets held in the town and the girls in this department have fed as many as three hundred people at a single gathering. Other work for the community is done by the girls, particularly during the canning season, when a substantial part of the canning done at Edgerton is the work of the domestic science department.

The electrical equipment consists of twenty-four electric stoves, two large electric ovens and one large electric range. The entire installation has cost the town of Edgerton practically nothing, as the department has been a financial success, the equipment having been purchased from money earned by serving banquets and doing canning work for various people in the community.

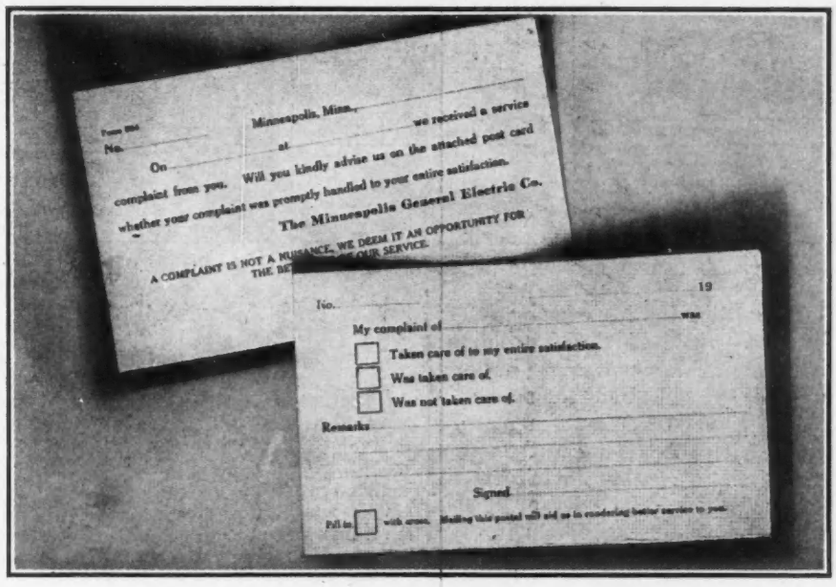
Customers' Deposits Not Advance Payment

IN HANDLING central-station customers' accounts some companies are requiring step-by-step deposits in the following manner: Before service is granted an initial deposit of $5 is required. Assuming a bill of $1.50 for the first month, this amount is substracted from the $5 payment, leaving $3.50 to the customer's credit. Assuming a bill of $2 each for the next two months, the customer owes the company 50 cents at the end of the third month. The company then collects this balance and asks for another $5 before being willing to continue the service. The utility naturally objects to paying the customer interest on his balance under these circumstances.

Discussing this practice recently with a representative of the ELECTRICAL WORLD, W. M. Black, chief engineer of the Maine Public Utilities Commission, Augusta, pointed out that the officers of such companies have clearly mistaken a deposit for an advance payment. "A deposit," said Mr. Black, "is a sum paid to the company by the customer which remains in the possession of the company until the customer ceases to obtain service from it, or else the company voluntarily returns the deposit, feeling that such a guarantee is no longer necessary in the particular case. The sum has no relation to the current bill for service. The bill is rendered just as though no deposit had been made and payment is expected in the usual manner. Should the customer refuse to pay his bill, the company would then discontinue the service, subtract the amount due from the sum deposited and return the balance to the party making the deposit. When the situation is understood there does not seem to be any reason for changing the rule requiring that interest be paid on a customer's deposit before service is rendered."

Post Card Follow-Up of Complaints

THE Minneapolis General Electric Company makes a practice of sending out daily to customers who have entered a trouble call with its service department about twenty post cards with prepaid return cards attached. For the most part cards are sent at random, but whenever a complaint is received from a customer who is inclined to be critical particular care is taken to see that that customer receives a post card.


Minneapolis, Minn.
complaint from you. Will you kindly advise us on the attached post card
whether your complaint was promptly handled to your entire satisfaction.
The Minneapolis General Electric Co.
A COMPLAINT IS NOT A NUISANCE, WE DEEM IT AN OPPORTUNITY FOR
No.
19
My complaint of
was
Taken care of to my entire satisfaction.
Was taken care of.
Was not taken care of.
Remarks
Signed
Fill in with crayon. Mailing this postal will aid us in rendering better service to you.

RETURN POST CARD INVITES CRITICISM OF SERVICE

From the returns received the company has learned that customers look upon these cards as a convenient means for registering a criticism in the event that they have one to make or for expressing commendations. The responses received by the company have enabled it to discover and rectify immediately any dissatisfaction which might grow to be a sore spot. The accompanying cut shows the form of card used. The practice has been in effect now for more than ten

years, and the company feels satisfied that the results gained in closer contacts with customers and clearing up of misunderstandings are well worth the time and expense incurred.

"Experience" Advertisements for Electric Vehicles

A SERIES of advertisements emphasizing the successful experience of local electric vehicle users has recently been started in the press of the territory occupied by the Edison

THE CARTER'S INK COMPANY
uses ELECTRICS because—
"economy of operation, low cost of upkeep and long life have been the dominant features in our experience," says Mr. R. M. Colbert, Traffic Manager
THERE could be no better reasons for choosing ELECTRIC trucks, but there are others which are good, and important. There's maximum safety, all-weather dependability, best control in city traffic, lowest insurance costs—and still many more advantages to ELECTRICS. Send for a copy of "The OTHER Reasons." Every reason is a fact
Winter proves ELECTRICS are best
Write or telephone to
EDISON LIGHT
ELECTRIC TRUCK DEPARTMENT
39 BOYLSTON ST. BEACH 3300
THE GINTER COMPANY
uses ELECTRICS because—
"we have found them an economical unit of transportation," says Mr. N. E. Whittemore
ECONOMY of operation is one of the sound principles on which good business is built. Because ELECTRICS cut delivery costs they are steadily increasing in commercial use. Greater safety, lower cost of upkeep, more days in service and fewer in the repair shop, are some other good reasons, and there are still more. May we send you a copy of "The OTHER Reasons"? Every reason is a fact.
Winter proves ELECTRICS are best
Write or telephone to
EDISON LIGHT
ELECTRIC TRUCK DEPARTMENT
39 BOYLSTON ST. BEACH 3300
EDGAR T. WARD'S SONS CO.
SALEM
uses ELECTRICS because—
"we have been perfectly well satisfied with the service we have had, not only in good weather but in the worst conditions of winter," says Mr. Edward T. Corbus, Branch Manager
THAT is something to think about, these winter months: all-year-round satisfaction with your trucks. ELECTRICS suffer least from snow and slippery pavements. They give no trouble in starting, they have no radiators to freeze. Winter is a good time to test a truck. Why don't you test an ELECTRIC?
May we send you a leaflet, about ELECTRICS, called "The OTHER Reasons"? Every reason in it is a fact.
Winter proves ELECTRICS are best
Write or telephone to
EDISON LIGHT
ELECTRIC TRUCK DEPARTMENT
39 BOYLSTON ST. BEACH 3300

TYPICAL REASONS FOR THE USE OF ELECTRIC TRUCKS GIVEN BY USERS

Electric Illuminating Company of Boston. The usual "talking points" for electric transportation are reinforced by quotations from executives in industrial and mercantile organizations testifying to the excellent service given by electric trucks over various periods. Every reason given in this series for the use of electric trucks is a fact from experience.

Adequate Electric Outlets for Denver Schools

THROUGH the efforts of the Electrical Co-operative League of Denver, Col., adequate illumination and a sufficient number of electrical outlets and switches are being installed in the new public school buildings now under construction in that city. By an arrangement with the board of education standard electrical equipment applicable to all classes of construction was recommended by the league to the board's architects and chief engineer.

So far plans on fourteen of the twenty-two individual school projects have passed through the hands of the league staff and have been checked with a view to making recommendations necessary in improving the installations.

The extent to which the league's recommendations have been accepted is set forth in the following results:

1. Increase of 200 watts to average classroom, thus boosting the illumination 1.2 foot-candles to an average intensity of 4 foot-candles.
2. Increase of 1 to 2 watts for every 3 sq.ft. in gymnasiums and auditoriums.
3. Use of standard commercial lighting units, generally of the total inclosing type.
4. Average distancing of ceiling outlets in corridors reduced from 40 ft. to 20 ft.
5. Installation of conduit in all classrooms, assembly halls and auditoriums to permit ultimate use of loud speakers in connection with the plan to "radioize" Denver's public school system. (In the meantime this conduit is finding economical use in providing wires for clocks and buzzers.)
6. Installation of one convenience outlet, duplex flush type, and addition of one switch in every room, large or small.
7. Distancing of foot-lighting outlets on stage reduced from 12 in. to 6 in. and 9 in.
8. Addition of one and generally two Kleigel outlets to school auditorium stages.
9. Footlights supplemented by border lights on all stages.
10. Installation of convenience outlets in orchestra pits of all school auditoriums.

Something of the results in boosting business for the electrical industry are shown by the general field work of the league. Figures show an actual increase of 5,012 outlets to jobs, such as office and store buildings, display windows, theaters, schools and residences.

ADDITIONAL OUTLETS ADDED DURING 1923

	First Six Months	Second Six Months	Total
Convenience ..	1,437	1,374	2,811
Switch	205	312	517
Bracket	186	198	384
Ceiling	571	608	1,179
Miscellaneous .	45	76	121
Total	2,444	2,568	5,012

Selling Better Lighting in a Small City

HOW the central-station company that cannot well afford to employ an illuminating engineer can stimulate interest in better store and window lighting has been satisfactorily solved by the Colorado Springs (Col.) Light, Heat & Power Company. About two years ago the manager of the company hit upon a plan of utilizing students in the physics class of the local college. It was planned to have a student make surveys of store and window lighting and submit recommendations for improvement.

The company obtained a foot-candle meter and started a student to work. It was soon found that the young man had too many diverse interests to do the job properly. Another student was tried with the same result. An appeal was then made to the professor of physics, who agreed to try out the plan himself provided the president of the college did not object. The central-station manager finally sold the president the idea by showing him that it would give the college a better standing in the community, broaden its usefulness and give it more prestige. He pointed out how it would actually tie the college in with local commercial and industrial problems. It also offered an opportunity for closer contact with the business men of the community in a manner they could grasp from a commercial standpoint, making their support of the college a little stronger.

The physics professor has been carrying on the work now for two years, and the company, the consumer, the college and the man himself have all profited. He receives a monthly salary for his services and has taken a great interest in the work. He has made a study of illumination problems so that he can render the customer a truly valuable service, and during one summer vacation, while in the East, the company arranged to have him visit the lamp manufacturers and some of the laboratories to equip himself better to handle the work. The physics pro-

fessor spends some of his evenings and spare time making lighting surveys and working up his recommendations. The reports submitted to the customer contain the statement: "This report is furnished through the courtesy of the Colorado Springs Light, Heat & Power Company." In this way the central station is tied in and receives the credit to which it is entitled.

In the small town that has no college the professor of physics in the high school could be interested in the same way. Every institution of learning is anxious to increase its usefulness in the community, and there should be no difficulty in persuading a high-school principal or board of education of the value of such service. Naturally people of a city or town have a keen sense of local pride in their schools, and this has been a strong factor in the success of the Colorado Springs company's method of selling better illumination.

Revenue from Industrial Heating $1,500,000

INQUIRY among central-station power engineers who have taken one of the several courses in industrial electric heating under the auspices of the N. E. L. A. Power Bureau shows that in sixteen companies during the past two years a total of 18,000 kw. of industrial heating has been added by engineers taking the training. The energy consumption of this additional load totals 26,000,000 kw.-hr., says V. M. F. Tallman, chairman of the Power Bureau, and it has yielded a revenue of $485,000 to the central-station companies.

Prorating these results in terms of the total number of men taking the courses, it is estimated that the total gain to the central-station industry has been 50,000 kw. in heating load, an actual use of 80,000,000 kw.-hr. and a total revenue of $1,500,000. Beginning in the middle of March, a similar course will be conducted through the co-operation of the electrical manufacturers with the association.

Utility Makes Every Week "Thrift Week"

COMMENCING during "National Thrift Week," the Illinois Power & Light Corporation, with headquarters in Chicago and operating in various sections of the Middle West, launched a thrift campaign that will be waged throughout the entire year. "Make this your thrift year" is the slogan adopted. During the last four and one-half months of 1923, the company conducted a customer-ownership program which was responsible for the sale of over $2,000,000 worth of its 7 per cent preferred stock.

In the past utilities have sold their stock to the customers on the basis of safety, good return, marketability and soundness of the industry. Officers of the company point out that while the above practice is still essential, a customer-ownership program, to be of greatest value to the community, should go one step further and encourage the thrift idea with a definite saving plan, impressing upon the prospective investor the advantages which accrue to individuals who have saved a little money.

What Other Companies Are Doing

Denver, Col.—In reorganizing the commercial lighting department of the Public Service Company of Colorado the city has been divided into seven sections and a special representative appointed for each section. The company has entered upon a general campaign to raise the standards of illumination throughout the city, and, among other things, electric signs manufactured by the company are featured along with commercial units.

Boston, Mass. — An exhaustive industrial electric heating survey will be undertaken by the Edison Electric Illuminating Company, beginning Feb. 1, to determine the field for prospective business of this class in metropolitan Boston and adjacent territory served by the company. It is expected that about 500 industrial plants will be visited and that data on motor loads will be obtained for comparison with heating possibilities. It is planned to carry the survey through without interruption for sales efforts by the investigators, so that the work will furnish complete and timely information to the sales department. L. R. Wallis is superintendent of the sales department, and the heating survey will be in charge of J. L. Faden.

Providence, R. I. — A new stock issue in the amount of $3,264,000 dated April 1, 1924, has been announced by the Narragansett Electric Lighting Company, the books being open for subscriptions from February 1 to 21 inclusive. Employees desiring to increase their holdings will be allowed to subscribe to the new issue at par, $50 per share, in the ratio of one new share for each five shares held.

Unwired Homes Are Incomplete

When your family opens the door to your home
Is it a home they enter? Or just a Building?
Four walls and a roof don't make a home. The home must be built inside.
Light and warmth and comfort and convenience—these help to change a building into a home.
The greatest modern aid in changing a building into a home is electricity. Light it brings, cheerfulness, comfort. It lights, it cooks, it sweeps, it dusts, it washes. It serves in every room in the house. It drives drudgery from housework; it brings cheerfulness and splendor into your home.
If your house isn't wired for electricity, be without it no longer. We'll wire it complete—including lighting fixtures—for $2 down, 2 years to pay balance.
Telephone 123
HAVERHILL ELECTRIC COMPANY

Don't walk into a dark house
Let electricity precede you!
When you enter the house when you pass from room to room, from floor to floor, let electricity precede you.
Don't grope about in the dark. Don't risk the sometimes serious bumps and bruises.
This wonderful convenience—this scattering of the darkness before you—is merely an incidental advantage of the electrified home.
Electricity not only gives you the best lighting ever devised by man but serves in scores of ways to make your home more comfortable, more convenient, less a place of drudgery.
If your home isn't wired, we'll wire it for you $2 down, 2 years to pay the balance.
Telephone 123.
HAVERHILL ELECTRIC COMPANY

HOUSE-WIRING publicity lately run by the Haverhill (Mass.) Electric Company emphasizes the part electricity plays in making a home complete, and as shown in the two displays reproduced herewith calls attention to the convenience and low cost of electrical installations on deferred payments.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Air Preheater for Boilers.—F. S. B. HEWARD.—An air preheater has been developed which carries heat continually in a mechanical way from flue gases to the incoming air. The apparatus permits of ready application either to existing boiler plants or new installations. In operation, fresh air is drawn by fans into the upper portion of a casing, which is divided into two parts by a vertical partition. The air is confined to one side of the partition and passes downward to a similar semi-circular chamber through the body of a porous cylindrical drum or rotor. The flue gases from the boiler traverse the apparatus in the reverse way, entering the lower semi-circular chamber and passing upward through the rotor to the upper chamber, whence they are exhausted and impelled to the stack by another fan.—*Sibley Journal of Engineering*, December, 1923.

Ford Plants to Use Pulverized Coke.—A description of the River Rouge power plant for the Ford Motor Company, in which, by means of low-temperature distillation of coal, all byproducts are to be utilized. The characteristics of coke and coal, the resultant product, the pulverized-coal installation and power generation are discussed, and an analysis of coal used at this plant is made.—*Power Plant Engineering*, Dec. 1, 1923.

Electric Deflection Tests on Turbine Wheels.—A. MEYER. — Several serious cases of the breaking of turbine disks owing to vibrations made a close investigation of the cause and nature of these destructive vibrations very desirable. This paper gives a description of statical and dynamical tests of this nature on actual steam turbine disks. For the statical tests the disk, fastened to its shaft, was placed in a horizontal plane, and an electromagnet was arranged closely under the disk. The pole distance of the magnet was slightly smaller than the diameter of the wheel. By means of an adjustable frequency changer alternating current of zero to 150 cycles could be applied to the magnet. Depending on the frequency used, a great variety of disk vibrations could be produced, the exact configuration of which was made easily visible by sand carefully strewn upon the vibrating disk (Lissajoux figures). Disk vibrations with one, two, three and four node diameters could be produced. For the dynamic deflection tests the tested disk was driven in a vertical plane at various speeds. At the point or points where steam impinges upon the blading a direct-current electromagnet was placed at close distance. This magnet caused the deflection of the rotating disk, and an accurate recording device, the nature of which is not disclosed, measured the amount and the character of the dynamic deflections. The influence of the temperature of the running disk upon its vibrations was also studied. — *Brown-Boveri Mitteilungen*, December, 1923.

Generation, Control, Switching and Protection

Diesel Engine Shows Low Fuel Consumption.—A Diesel-engine plant consisting of two units operating at South River, N. J., has shown very little variation in consumption between the half load and full load. The acceptance test of a 700-boiler-horsepower direct-connected generator is given in the accompanying table. This engine was placed in operation Sept. 9, 1923.—*Power Plant Engineering*, Dec. 1, 1923.

SUMMARY OF ACCEPTANCE TEST RESULTS ON 700-B.-HP. DIESEL ENGINE

Load, per cent	62.2	101.0
Fuel oil consumed, gal.	13.0	85.0
Weight per gal., 72 deg. F.	7.027	7.027
Weight of fuel oil consumed, one-half hour	91.35	.....
Weight of fuel oil consumed, two hours	.....	597.35
Total kw.-hr. output, one-half hour	140.0	.....
Average power factor	0.745	0.78
Generator efficiency	0.8845	0.923
Total b.-hp.-hr. output, one-half hour	212.2	.....
Total b.-hp.-hr. output, two hours	.....	1394.7
Fuel oil consumed, lb. per kw.-hr.	0.652	0.622
Fuel oil consumed, lb. per b.-hp.-hr.	0.4305	0.428
Kw.-hr. generated per gal.	10.77	11.3
B.-hp.-hr. generated per gal.	16.32	16.4

Transmission, Substations and Distribution

Superpower Transmission. — PERCY H. THOMAS.—A study of the transmission of very large blocks of power for extraordinary distances made for the purpose of bringing out the major operating characteristics of such a system, the characteristics which it possesses which are different from those of shorter transmissions and the duties imposed on generators, transformers, synchronous condensers, switches, etc., primarily as affecting their design. A typical hypothetical transmission has been assumed, namely, a delivery of 400,000 kw. over a distance of 500 miles with four 220,000-volt circuits. The characteristics of this line are worked out, showing the efficiency, condenser capacity required, data on circuit breaker arrangements, protective relay connections on receiving network, provision for spare parts, switching of units and ratings of various apparatus. This paper is to be presented at the midwinter convention. — *Journal of A. I. E. E.*, January, 1924.

Extra-High-Pressure Transmission Lines.—R. B. MATTHEWS.—A four-part article discussing the chief points made in the papers and discussions at the high-tension conference in Paris, Nov. 11-Dec. 1, 1923. The subject was presented in three main divisions—the production and transformation of energy, the construction and insulation of lines, and the operation of the lines, including means for security, protection and also legislative matters. The rapid adoption of automatically operated substations in the United States was emphasized, and outdoor substations, oil circuit breakers, transmission towers, overhead lines, insulators, cables, standardization of voltage, overvoltage protection, earthing the neutral and technical regulation were discussed.—*Electrical Review (England)*, Dec. 7, 14, 21 and 28, 1923.

Units, Measurements and Instruments

Gaseous Ionization in Built-up Insulation. — J. B. WHITEHEAD. — In an earlier paper a series of tests on a number of 6,600-volt mica folium armature bars made up with different degrees of mica content was described. The variations of the dielectric losses with voltage and with temperature were studied, and by means of the application of pressure it was shown to what extent losses due to internal ionization were present. These tests are continued in the present paper. This paper is to be presented at the midwinter convention. — *Journal of A.I.E.E.*, January, 1924.

Terrestrial Magnetism. — D. L. HAZARD.—Results of observations made at the United States Coast and Geodetic Survey Magnetic Observatory at Sitka, Alaska, during 1919 and 1920 are given. The data record the hourly value of declination, horizontal intensity and vertical intensity for this location.—*Serial No. 242 of the United States Coast and Geodetic Survey.*

Measurement of Reactive Power.—R. S. J. SPILSBURY.—The author covers the theoretical design of reactive meters of the induction watt-hour type. Reactive power meters for single-phase circuits are first discussed. Meters of this class may be made so as to have no theoretical errors inherent in their construction, although practical errors of construction are more difficult to eliminate than in real power meters. In three-phase circuits an additional complication is introduced by the possibility of unbalancing, which in practice is fairly general. The reactive power in a balanced three-phase system may be measured by the single-element, the crossed-phase, two-wattmeter-difference, zero-lag and composite-voltage methods. The author discusses these

in detail. The effect of unbalance in a three-phase system is to impair the accuracy of certain of these methods, and the more important of the deviations are pointed out.—*Beama*, December, 1923.

Illumination

Eleven Solutions of a Street-Lighting Problem. — Following a letter and questionnaire sent out by the Illuminating Engineering Society on a thoroughfare-lighting problem, eleven solutions of the problem were received. A typical thoroughfare in a city of 100,000 population was chosen so that the answers would be comparable. Each solution gives the cost of lighting installation, intensity of light, type and size of lamp, type of circuit, arrangement of lamps, distance between lamps, description of fixture and post and type of apparatus adopted. — *Transactions of I. E. S.*, December, 1923.

Development of the Incandescent Lamp.—B. P. DUDDING and C. J. SMITHELLS.—The second of a series of articles on the development of the incandescent lamp in which the authors outline the glass working and other processes involved in the manufacture of vacuum and gas-filled tungsten-filament lamps. After describing the sorting and cutting of the glass, the making of the filament supports and the preparation and mounting of the filament are considered. The various methods of forming the glass bulb and of evacuating the lamps are also covered.—*Beama*, December, 1923.

Motors and Control

Variable-Voltage Control Systems as Applied to Electric Elevators.—E. M. BOUTON. — The author describes the variable-voltage system of control of electric elevators and sets forth the characteristics and operations obtained with special regard to acceleration, retardation, speed control, speed regulation, efficiency, economy, maintenance and safety. The author claims the following advantages of this system over older systems: (1) Elevators running at the highest speeds may be driven from alternating-current supply lines of any commercial voltage and frequency. (2) The acceleration and retardation are perfectly smooth and uniform. (3) A high rate of acceleration and retardation is obtained. (4) Positive speed control under all conditions. (5) High economy of power. (6) Maintenance costs are reduced to a minimum. (7) The reliability of service is increased. This paper is to be presented at the midwinter convention in Philadelphia.—*Journal of A. I. E. E.*, January, 1924.

Electric Drive for Pump.—R. H. ROGERS.—The author discusses the effects of pipe sizes on the cost of pumping, the effect of methods of controlling pump output on motor-power consumption and how to choose motor and control equipment for use on pumps.—*Power*, Dec. 18, 1923.

Heat Applications and Material Handling

New Type of Electric Resistance Furnaces. — ASSAR GRÖNWALL. — The author describes several designs of a new type of electric furnace. The fundamental feature of the new furnace is the use of graphite resistance insulated in tubes of an alum compound. Furnaces of small capacity are arranged similarly to those of the ordinary type which have resistance of metal. The graphite resistors for greater capacities are formed out of plates which are cut zigzag. The furnaces are made for various purposes for temperatures from 900 deg. to 1,300 deg. C.—*Teknisk Tidskrift* (*Sweden*), *Bergsvetenskap*, Dec. 8, 1923.

Electric Heating of Residences.—Part II.—E. A. LOW.—A continuation of a former bulletin on the heating of residences by electricity as carried out in the city of Tacoma, Wash. The second study gives a classification of residences, a general summary showing growth of the heating load, consumption by typical consumers, classification on basis of connected load, influence of outdoor temperature and relative humidity on energy consumption, climatic conditions and housing.—*Bulletin No. 20 of the Engineering Experiment Station, University of Washington.*

Electrophysics, Electrochemistry and Batteries

Storage-Battery-Driven Cars—II.—J. BOËS.—In this second part of his paper the author gives very detailed and complete information concerning the individual parts of electric vehicles. He describes various makes of storage batteries of both the lead and the nickel type, compares the properties of motors generally used on these cars, goes into details of electrical control and mechanical arrangements, and gives finally, as the bulk of this part of his article, a remarkably complete account of all the various types of body construction used for passenger cars and utility cars. This part of the article alone has thirty-five illustrations, most of them drawings. American, German, English and Italian types of cars are considered. A two-page bibliography going back to 1912 concludes the treatise.—*Revue Générale de l'Electricité*, Dec. 15, 1923.

Traction

Electrification of Steam-Operated Viennese Subway.—C. HOCHENEGG.—The steam-driven underground and elevated lines of Vienna were so uneconomical that under the pressure of war curtailments and the subsequent coal shortage their upkeep was abandoned, and they have not been operated since. As the general conditions gradually improved the author, who is the leading Austrian authority on electric traction, submitted a plan to the federal authorities for the electrification of the entire Viennese transit system. The general outlines of this urban and suburban rapid-transit system, together with a cost estimate, are given in this article. Trains of two motor cars with one trailer between them are suggested. The design of the motor cars shows a number of unique and interesting features, all of them intended to carry out the electrification with as few changes in the present track structures as possible. The substations for the road are assumed to contain mercury-arc rectifiers of 825-kw. output, to transform 5,000-volt three-phase current into 1,500-volt direct-current traction voltage. The entire program is estimated to cost not over 20,000,000 gold crowns, or about $4,000,000.—*Elektrotechnik und Maschinenbau*, Dec. 23, 1923.

Telegraphy, Telephony, Radio and Signals

Recent Developments in High-Vacuum Receiving Tubes. — J. C. WARNER.—The operating characteristics of radiotrons UV-199 and UV-201-A are given, together with the general considerations which determined the design of these tubes. A method of rating receiving tubes (in place of mutual conductance) when appreciable undistorted output is required, as for loud speaker operation, is discussed.—*Proceedings of Institute of Radio Engineers*, December, 1923.

Scientific Applications of Radio Telegraphy.—GEN. G. FERRIE.—The author discusses many of the more important researches and scientific undertakings that have aided in the development of radio telegraphy and telephony. The article covers the most important applications of Hertzian waves. —*Journal of Franklin Institute*, December, 1923.

Miscellaneous

Developments in the Electrical Industry During 1923.—JOHN LISTON.—Record volume of production in practically all classes of apparatus marked the year 1923. Although this high-pressure production is not usually conducive to radical changes in design, there were a number of distinctly new developments which represent advances in the art. Increased size of generating units, converters and transformers is noted. In transportation, electric propulsion was applied to large craft for canal service. Automatic stations were extended to new industrial fields and initial foreign installations were made. For radio service new tubes were developed of both higher and lower power than any previously produced. Investigations in high-potential phenomena were continued, high-voltage direct-current testing sets and X-ray tubes of great power were developed, photo-electric cells were applied in the operation of a commercial machine, and a complete new line of electrically operated flow meters was standardized.—*General Electric Review*, January, 1924.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Committee for Ford Offer

It Stands Thirteen to Six for Him on Divisions Over McKenzie Bill Provisions

WHEN the House of Representatives military affairs committee, which is holding hearings on Muscle Shoals propositions, reconvened this week the following telegram from Henry Ford was read into the record by Chairman Kahn:

"Your committee has had our proposal before you for practically two years. Our offer has been fully inquired into and explained. The committee has reported to Congress two bills for acceptance of our offer. I know of nothing that we can add that will be helpful to you.

"Further hearing would only serve to delay action and unnecessarily consume time of a busy and important committee of Congress, already in possession of all facts."

Mr. Ford, therefore, did not appear before the committee in person or by representative.

A Fourth Offer Submitted

Just before the hearings closed E. H. Hooker, the president of the Hooker Electrochemical Company of Niagara Falls, on behalf of himself, Gen. W. W. Atterbury, vice-president of the Pennsylvania Railroad Company, and J. G. White, head of the White Engineering Company of New York, submitted the fourth offer in connection with the Muscle Shoals properties. The Hooker offer proposes the formation of a company in which the United States will own 75 per cent of the stock. The company is to operate the water power and the nitrate plant. As an evidence of good faith Mr. Hooker and his associates will contribute an operating fund of $1,000,000. During the first ten years they are to receive 2.66 per cent of the profits of the operation and after that 2 per cent, the balance to go to the government. They agree to set aside certain sums for research purposes and contend that their offer from a dollar and cents standpoint is more advantageous than any one of the others. Mr. Hooker is president of the Manufacturing Chemists' Association. He told the committee that over a fifty-six-year period, without computing interest, the Ford offer would return $70,000,000 to the government. The offer of the associated power companies, he said, would return to the government $159,000,000. The offer which he presented, he declared, would return to the government at least $260,000,000, with a possible maximum of $500,000,000.

A trend away from the Ford offer was exerted to some extent by the refusal of Mr. Ford to appear before the committee, but the real force behind any change of position was the appearance of representatives of farmers, manufacturers and chambers of commerce, representing states in the Muscle Shoals region, who urged the utilization of the power for public utility uses rather than for manufacturing at Muscle Shoals.

The committee closed its hearings on Tuesday with the four offers—the Ford proposal, the Southern power companies', the Union Carbide Company's and the Hooker Electrochemical Company's—before it. On Wednesday it proceeded to the consideration of the McKenzie bill, which is a pro-Ford measure.

Ford Men Win Two Points

The bill is being passed on section by section in executive session as this is telegraphed from Washington. Two important fights have been won by the Ford adherents on record votes of thirteen to six, with Chairman Kahn ill at home and not voting. This is taken to mean that some sort of a Ford bill will soon be reported out of the committee.

One of the fights won by the Ford adherents was that Mr. Ford should not be required to come under the federal water-power act, an exception in his favor having been declared by the committee. The other was that Mr. Ford should not be required to pay interest on the $17,000,000 expended by the government on the Wilson Dam as a war measure. Whether the House of Representatives will approve these ideas when the bill comes on the floor remains to be seen.

It seems evident that the proposal of the associated Southern power companies will not have more than six or seven votes at most of the total twenty-one in the committee, but Representative Hull of Iowa, who is leading the fight in behalf of the power companies' offer, hopes that their proposals will receive more consideration on the floor.

Representative McKenzie of Illinois, who is leading the fight for the Ford offer, intends, as far as he can consistently do so without harming that offer, to safeguard all other interests of the government. He states to the Electrical World, for one thing, that he intends to amend his own bill in committee by requiring Mr. Ford to begin to pay interest on the government investment from the time the Ford offer was made rather than from the date when his offer shall be accepted by Congress, as the bill now reads. Not to do so would permit Mr. Ford to escape paying interest on the $25,000,000 the government has expended during the last two years. The committee does not know whether Ford will accept this provision, but even his friends say that if he does not he will lose any chance he may have of getting Muscle Shoals.

Southern Companies' Fertilizer Offer

Propose Five-Million-Dollar Corporation to Take Fifty-Year Contract to Run Nitrate Plants, Producing 50,000,000 Tons a Year at 8 per Cent Profit

THE associated Southern power companies which recently offered to lease the government properties at Muscle Shoals, Ala., for fifty years at a total rental approximating $100,000,000 have, as anticipated, made a further offer covering the production of nitrates. This offer was on Friday of last week sent by the Secretary of War to the House military affairs committee, which already had before it the offer of the Union Carbide Company reported in these columns on January 26. The Southern companies' offer was sponsored by B. C. Edgar, general manager Tennessee Electric Power Company; E. W. Hill, vice-president Memphis Power & Light Company, and Thomas W. Martin, president Alabama Power Company. These officials gave out a statement in explanation of their offer, of which the main paragraphs follow:

"The associated public utility power companies which have submitted an offer to pay $100,000,000 for a fifty-year lease for the Muscle Shoals power under the federal water-power act are submitting to Congress an offer to organize a corporation to produce fertilizer at Muscle Shoals. Associated with these companies will be Theodore Swann, Dr. Louis C. Jones and Dr. R. F. Bacon, who are scientists and experts in the manufacture of fertilizer ingredients and air-fixation processes.

"The fertilizer company will have a capital stock of $5,000,000 and will offer to lease Nitrate Plant No. 1 for fifty years and immediately begin construction of plants and equipment and will agree to produce 50,000 tons of fixed nitrogen annually in the form of ammonium sulphate, ammonium phosphate or other nitrogenous concentrated fertilizer and also calcium arsenate.

"These fertilizers will be offered for sale to farmers, farmers' organizations and other consumers of fertilizer at 8 per cent profit on the actual cost of

production. The fertilizer company will use 100,000 hp. made available at cost of production by the power company's offer and will also consume an additional 40,000 hp. when required for fertilizer production on terms to be fixed by the Federal Power Commission, the power companies offering to provide additional power as necessary.

"The fertilizer company will agree to maintain Nitrate Plant No. 2, the cyanamid plant, in standby condition for the production of nitrate for munitions of war until Congress shall otherwise direct. The offer provides that the United States will have the right upon five days' notice to take over the plant of the fertilizer company for national defense.

"We are advised by Dr. Bacon and other experts that by the processes which will be employed at Nitrate Plant No. 1, if this offer is accepted, the farmer will be able to obtain on his farm fertilizer at less than half the price he is now paying.

"The fertilizer company will immediately begin construction of plants and equipment to produce at least 5,000 tons annually of fixed nitrogen and will increase production to 50,000 tons as rapidly as demands from farmers and other consumers require.

"The power companies and their associates have secured the right to employ an American process recently developed and put in successful commercial operation at Niagara Falls by the Mathieson Alkali Works, being based in large part on the work done over the past few years at the fixed-nitrogen research bureau at Washington; also the Casale process, originated in Italy and commercially used for a number of years in nitrogen fixation, and a modified and improved Haber process. It will also employ, among other phosphoric-acid processes, the process perfected by the Federal Phosphorus Company of Anniston, Aa."

E. A. Yates, vice-president and general manager Alabama Power Company, appeared before the military affairs committee and made an extended statement in explanation of the Southern companies' proposal, answering many questions asked by the committee members. He put before that body a parallel-column comparison of the Southern companies' proposal and Henry Ford's which showed to the advantage of the former a production annually of 50,000 tons of fertilizer as against 40,000 tons, the use of a less expensive process with cheaper product, the provision of 100,000 hp. at cost and 40,000 hp. at price set by the Federal Power Commission as compared with indefinite terms, and better provisions for war production of nitrogen, for disposition and maintenance of plants and for governmental remedy in case of breach of contract.

Franklin Fund's Posthumous Award to Steinmetz

A posthumous award of £1,000 and republication rights has been made by trustees of the Benjamin Franklin Fund in London to Charles Proteus Steinmetz for a privately published treatise on "The Nervous System as a Conductor of Electrical Energy."

This award and others also just made total £4,000 and are the first to be bestowed by the Benjamin Franklin Fund, which has grown from an original endowment of £100 given by Franklin in 1759, at which time he represented the American colonies in England. This fund by its terms was to be invested for 150 years before being drawn upon, subsequent to which it was to form the principal of a trust from which awards were to be made from time to time at the discretion of the trustees for contributions to curative science.

Ontario Hydro Commission Urges Morrisburg Plant

The Hydro-Electric Power Commission of Ontario made application last week to the Department of Public Works at Ottawa for permission to proceed with its development plan to make use of the water of the St. Lawrence River at Morrisburg. The plans, as submitted to the department, comprise excavations, channels, dams and sluiceways. In making a statement in connection with the application Sir Adam Beck, chairman of the commission, pointed out that, if the work proceeds, there will be an installation of from thirty-four to thirty-six units, each capable of a development approximating 10,000 hp., making a total of about 350,000 hp., on the Canadian side. Even if the work should proceed at once, it would take from four to five years for completion, and Sir Adam added that nine out of twelve of the existing systems will be short of power one or two years before the Morrisburg plant could be put in operation. It has been estimated that the scheme will save an annual coal consumption of 2,000,000 tons and an operating expense of $12,000,000 yearly, as compared with steam development of the same amount of electricity. The total cost is put at $75,000,000, to be divided equally between Canada and the United States.

Poor Fall of Rain and Snow Threatens Hydro Plants

The power companies of California face a water shortage due to the fact that precipitation is below normal, and if the situation does not improve they will have to depend upon steam to generate a large proportion of their power during the coming season. The snowfall in the mountains in the northern part of the state is only about 30 per cent normal, and in the south it is even less. However, 50 per cent of the precipitation in the Sierras comes after the first of February, and the season's deficiency may still be made up. Almost no rain had fallen throughout the state this season until a few days ago, when there was a general downfall. The extensive interconnected system in California will be utilized to the fullest extent in relieving the situation, and it is possible that the Railroad Commission will call a conference of all power companies to work out a plan for co-operation in case conditions do not improve.

Million-Volt Laboratory Is Nearing Completion

The laboratory building on the campus of the California Institute of Technology at Pasadena, Cal., has been completed and the apparatus is being installed. Four 250,000-volt transformers, with a capacity of 1,000 kw., have arrived and are being set up. This million-volt laboratory, the first to be established in the West, was made possible through the co-operative effort of the Southern California Edison Company and the California Institute of Technology. The power company furnished the building and the school is furnishing the equipment. The research work will be carried on under the direction of Dr. Robert A. Millikan and others.

DELEGATES FROM TEN NATIONS TO INTERNATIONAL CONFERENCE ON HIGH-TENSION TRANSMISSION HELD AT PARIS RECENTLY

Radio Monopoly Attacked

Federal Trade Commission Makes Formal Complaint Against the Eight Companies Concerned

IN ACCORDANCE with its report declaring the existence of a monopoly in the control of radio apparatus (see ELECTRICAL WORLD, December 8, page 1189), the Federal Trade Commission has issued a formal complaint that a monopoly has been formed in radio apparatus, both domestic and foreign, and that efforts are being made to perpetuate the present control beyond the life of existing patents. Approximately two thousand patents are involved.

The Radio Corporation of America, General Electric Company, American Telephone & Telegraph Company, Western Electric Company, Inc., Westinghouse Electric & Manufacturing Company, International Radio Telegraph Company, United Fruit Company and Wireless Specialty Apparatus Company are named as respondents and are alleged to have violated the law against unfair competition in trade to the prejudice of the public. They have thirty days in which to answer the complaint.

Three statements emanating from officials of companies involved have been published in response to the charges. James G. Harbord, president of the Radio Corporation of America, said: "Patents that were incomplete and inadequate in themselves when used in conjunction with one another removed the barriers to a great national development that has resulted in extensive commercial transmission of wireless telegraph messages and has given employment to thousands of men and women and educational and entertainment facilities to millions." H. B. Thayer, president of the American Telephone & Telegraph Company, declared that the effect of that company's agreement with the General Electric Company was not to restrain trade but to expand it.

PRESIDENT SWOPE'S STATEMENT

President Gerard Swope of the General Electric Company issued the following statement:

"The connection of the General Electric Company with the question of radio communication dates back to the war. At that time the radio communications in this country were handled by the American Marconi Company, controlled by the British Marconi Company. The General Electric had developed a high-frequency generator for radio transmission which was new in the art. The thought of the company at first was to sell this apparatus to any radio communication company that desired to have it, but at the request of one of the departments of the government, which had been using this high-frequency generator in radio transmission and did not look favorably upon the control of radio communication for the United States being in the hands of a foreign company, General Electric was induced to take the lead in the reorganization of the American Marconi Company, which eventuated in the formation of the Radio Corporation of America, with the entire elimination of foreign interest. To make the Radio Corporation the most efficient instrument for transoceanic communication, the General Electric Company made a contract with the Radio Corporation giving to the latter the benefit and the advantage of all inventions it had made and would make in the future. To further strengthen the position of the Radio Corporation in this art, similar contracts were made with other companies, the idea being to put the Radio Corporation in possession of those patents necessary to make it an efficient organization for radio transmission and enable it to best serve the public interests.

"This was all known to the government, and a representative designated by the government sat on the board of directors of the Radio Corporation for some time after its organization. Officials of the Radio Corporation appeared before a congressional committee on this subject, where all of these relations relating to the formation of the Radio Corporation were told in detail."

Northern States to Build Belt Around Twin Cities

The Northern States Power Company has just allotted $300,000 of its ten-year building program funds to be used this summer in the completion of a high-tension transmission line completely encircling Minneapolis and St. Paul. The line is expected to add considerably to manufacturing expansion possibilities in both cities. The main work to be done this year will be on a 20-mile link extending from Mendota, just west of St. Paul, to a power station at the southwest corner of Minneapolis. When the last link is finished this year the power-line loop will extend east of St. Paul, south of Minneapolis and St. Paul and some distance north and west of both cities.

The Northern States Power Company has a contract with the Ford Motor Company to use any excess power from the High Dam development not used by the Ford company at its Twin City plant and is considering the erection of a transmission line to this plant along a railroad right-of-way so as to be able to feed excess power from the dam into its transmission loop.

Western Inspectors Confer on Code Interpretations

Explanations of the changes in the new 1923 National Electrical Code characterized the nineteenth annual meeting of the Western Association of Electrical Inspectors, held at Omaha January 29-31 with an attendance of 150.

In support of uniform ordinances Charles A. Bates, Bridgeport, presented one recommended by the Electrical Manufacturers' Council which had as its basis the standards laid down by the new code.

L. W. Going, chief electrical inspector for the city of Portland, Ore., told how the sale of sub-standard electrical equipment was stopped in Portland by an ordinance requiring all dealers, including electrical contractor-dealers, hardware stores and druggists, to be licensed. No licenses were issued to dealers not handling approved equipment. Though not yet tested in a superior court, the first year's operation has been successful in clearing from the market cheap, unapproved and hazardous electrical equipment.

Much discussion took place on Wednesday on the subject of grounding, and the code was interpreted by M. G. Lloyd of the Bureau of Standards.

L. A. Barley and E. L. Kopl thought that a neat safety switch could be built directly to an electric range, doing away with objection to such installations.

A strong sentiment existed against the 15-amp. fusing rule, No. 807, although up to Wednesday night no action was taken on this matter.

Motor Truck Manufacturers Back S. E. D. Program

Twelve electric street truck, battery and accessory manufacturers met with the directors and staff of the Society for Electrical Development, who are particularly interested in the truck promotion program, at the society headquarters in New York on January 25. The presidents of five companies were present, other companies being represented by executives.

James H. McGraw and R. C. Lanphier, representing the directors of the society, reviewed the progress that has been made in carrying forward the twenty-five-thousand-dollar truck promotion program which was undertaken last June in co-operation with the manufacturers.

The present status of the vehicle industry and the principal opportunities for promoting the truck business were discussed in detail. The purpose of the meeting was to determine the value of the work that has been done so far and to establish the extent to which the manufacturers desire to support the program.

The Electric Transportation Bureau of the National Electric Light Association was represented by its chairman, Charles R. Skinner, who outlined the plans of his bureau and described the services which the society has rendered to the bureau in the carrying out of its work. Mr. McGraw stressed the need of educating central-station executives to the opportunities that the electrical vehicle offers and the importance of developing a more sympathetic and constructive competition among manufacturers of trucks and batteries.

G. A. Freeman, vice-president of the Walker Vehicle Company; C. A. Ward, president of the Ward Motor Vehicle Company, and E. R. Whitney, president of the Commercial Truck Company, all pledged the financial support of their organizations to the program and the full co-operation of their organizations. Strong indorsement was given by every manufacturer present, and it was agreed that a second meeting of these heads of the electrical truck industry should be held in the near future to give consideration to the detailed promotion plans which the society has under development.

Modus Vivendi at Albany

Party Opponents Agree on Water-Power Bill—To Defer Important Action for a Year

FOLLOWING a conference between Governor Smith on one side and Speaker Machold and other Republican leaders on the other, a compromise on the question of water-power development and control by the state is said to have been reached by which, while the Governor's program for a State Power Authority will not be carried out this year in its entirety, a body under that name will be set up which will be designed eventually to follow his plan of issuing bonds against projected improvements without pledging the state's credit. For the present, under the agreement known to have been reached, the State Power Authority would have no such power, and its functions would be limited to the making of surveys and initial plans. These plans would be subject to the sanction of next year's Legislature, which might accept or reject them when submitted, and the entire scheme would, of course, be subject to reversal by a body in which the same party controlled both houses. At present the Democrats have the Governor and the Senate, and the Republicans the lower house.

No Permits Likely This Year

It is not now regarded as likely that any power development permits will be granted by the existing commission in the coming year. Since the Democratic majority in the Water Power Commission took office a year ago it has been its policy to hold all applications pending action that would fix the state's policy. Under the agreement reached by Democratic and Republican leaders no definite action can be expected before the 1925 session.

Only four petitions are involved in the delay, two affecting St. Lawrence sites and two the lower Niagara River. All have been pending since 1921. The St. Lawrence Transmission Company seeks a permit for exploiting the Long Sault Rapids. The Louisville Power Company has an application involving Croll Island, also in the St. Lawrence. For the lower Niagara River the first company to seek power development rights was the Lower Niagara River Power & Water Supply Company, at the head of which is Fred D. Corey of Buffalo. His application bears date of May 7, 1921. On June 11 following the Niagara Gorge Railroad Company made application. At the head of this company is Burt L. Jones. Later this company appeared in reorganized form and as the Niagara Gorge Power Company filed a new application. The only development last year was the appearance of what is styled the American Superpower Corporation, representatives of which left applications with the Water Power Commission, but did not formally file them.

Since 1900 there have been something like six surveys made of the power possibilities of the state, so that the new commission to be created will not be entering a virgin field of exploration, but will have for its guidance hundreds of printed pages of data.

Steps to force the Niagara Power Company to pay rental to the state for the use of 4,400 cu.ft. a second of water that goes over Niagara Falls are expected to follow action taken by the New York Water Power Commission in referring the matter to a committee composed of Attorney-General Sherman, State Engineer La Du and Speaker Machold of the Assembly. Up to the present time the company has paid nothing for use of this water, which is the last that can be utilized under the existing treaty between the United States and Great Britain. Company officials are said to have declared that a rental charge would have to be met by a rate increase.

Every city would be empowered to regulate and control rates and charges of gas and electric companies under a bill introduced into the New York Senate by Senator Lacey of Buffalo, Democrat. The measure would add a new section to the Public Service Commission law.

Electric Service Standards Circular Revised

A new edition of the Bureau of Standards circular on "Electric Service Standards" has just been issued by the Department of Commerce. The material contained in the old edition has been revised when necessary and brought up to date. This first edition has been the basis for many of the rules for electric service which are now in force in many of the states and which cover such subjects as the accuracy of meters and means for testing them, interruptions to service, variations in voltage on electric lines, safety provisions, methods of metering, etc. These rules for the various states are embodied in the circular and recommendations are made for the framing of such rules where they do not already exist.

In collecting this material the Bureau of Standards sent its experts all over the United States to confer with commissions and engineers having to do with the regulation of public utilities. In twenty-one of the states electric service rules were found to be in force, while in forty there are laws giving a commission power to regulate the corporations furnishing public utility services.

This book is known as Circular 56, second edition, of the Bureau of Standards, entitled "Standards for Electric Service." It can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 60 cents.

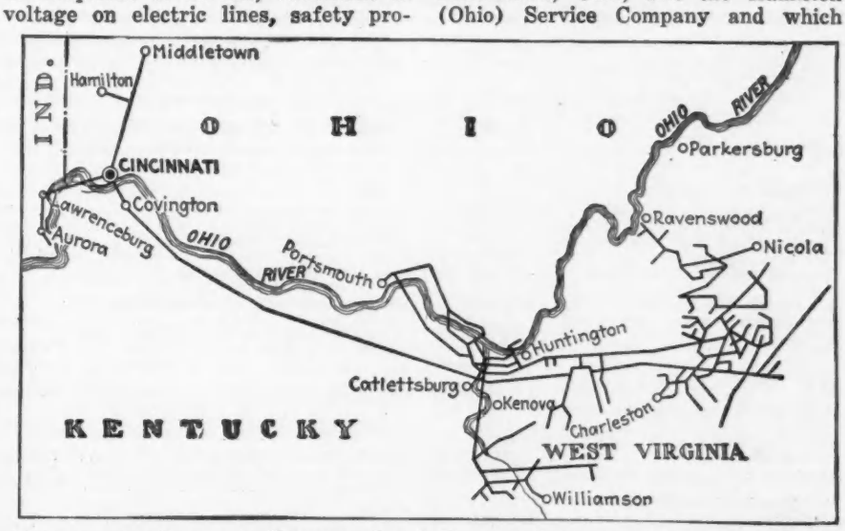
Montreal Power Cuts Rate and Increases Dividend

Very recently the Montreal Light, Heat & Power Consolidated simultaneously reduced its electric lighting rate from 4½ cents to 4 cents per kilowatt-hour and increased its dividends from 6 per cent to 7 per cent, thus dividing between its customers and its shareholders the benefit of a prosperous year. This double action was in accordance with precedents established by the company in previous years, the rate for lighting having gradually come down from 12.75 cents in 1908. Previous to a three-to-one stock split in 1916 the dividend had reached 10 per cent. Since then it has ascended from 4 per cent. Stock is now quoted as high as 143½, compared with 83 (high) in 1916 and 250 (high) before the split.

Columbia Gas & Electric Has Record Profits

The Columbia Gas & Electric Company, which last summer took over the Ohio Gas & Electric Company of Middletown, Ohio, and the Hamilton (Ohio) Service Company and which controls the Union Gas & Electric Company of Cincinnati, announces that 1923 saw the largest earnings in the company's history, the surplus after charges being $6,403,960, an increase of $1,322,000, or about 26 per cent, over the surplus in 1922.

Under the plan of employee subscription to stock of the company announced last summer, 36,500 shares of stock were acquired, while subscriptions exceeded that amount. The allotment per employee averaged thirteen shares.



TRANSMISSION SYSTEM OF COLUMBIA GAS & ELECTRIC COMPANY REACHES FOUR STATES

Schools of Lighting to Be Conducted on Pacific Coast

Seventy-five members of the Commercial Section committees of the Pacific Coast Electrical Association met at Del Monte, Cal., January 25 and 26, for the second conclave of the year. Every committee has been working hard, and there will be real accomplishments to report at the convention of the association in June. The Lighting Bureau will conduct three lighting schools for educating power company salesmen, contractors, dealers and others in the sale of lighting. It is not the intention to make illuminating engineers out of these men, but to give them a training in the fundamentals of illumination and equip them to lay out a lighting installation after a merchant has become interested in the portable window-lighting exhibit of the co-operative campaigns. Schools will begin in the early fall in San Francisco, Fresno and Los Angeles.

Wisconsin Has Women's Committee for All Utilities

Wisconsin is the first state in the country to form a women's committee on public utility information covering i united electric, gas, street-railway and telephone industries, such a body having just been organized by the Wisconsin Utilities Association. This committee will assist each company in forming its women into study classes and will provide lectures dealing with the fundamental problems of the utility business and suggest general plans whereby women can make themselves more useful to the companies in their efforts to provide efficient service to the public. The movement also paves the way for women to occupy more important positions in the utility business. The committee members include five women from companies furnishing electric service in different parts of the state.

E. M. Herr Addresses Fitkin Representatives

Addressing the annual meeting of the managers of the General Engineering & Management Corporation, associated with A. E. Fitkin & Company, which was held in New York City last week, E. M. Herr, president Westinghouse Electric & Manufacturing Company, said, alluding to the fact that ten years ago the amount of electrical energy generated was only about one-fourth of what it is today:

"The connected load of generating apparatus has not increased in anything like that proportion, which means, of course, increased efficiency and increased ability of the machines we are producing today, and the end is not yet. That progress is continuous and, I believe, will be for some time. I think it is a great tribute to our engineers when we realize the remarkable improvements made in power-plant equipment during the past few years. The great problem of the electrical manufacturers lies not so much in taking care of present-day requirements as in trying to anticipate and provide for the demands of this great electrical industry five years hence. It is difficult to visualize sufficiently far ahead to enable provision to be made fast enough, to get plants big enough and competent organizations trained to do the work the public utility business demands, and that is the job we are addressing ourselves to now with absolute concentration."

Joint Dinner at Philadelphia Convention Next Week

The American Institute of Electrical Engineers and the Society for the Promotion of Engineering Education will unite at an informal dinner under the joint auspices of these organizations at Philadelphia on the evening of February 6, following dedicatory exercises at the Moore School of Electrical Engineering. The new project of investigation and development in the field of engineering education being undertaken by the S. P. E. E. will be discussed. Tickets may be obtained at the A. I. E. E. convention headquarters in the Bellevue-Stratford Hotel.

Utility Financing Fairly Active in First Month of Year

PUBLIC sales of electric light and power utility securities by investment houses during the month of January amounted to $57,594,000. This figure, though considerably less than the total recorded in January, 1923, reflects a fairly active market when the huge total of the preceding month—December, 1922—is taken into consideration. Conditions were reversed a year ago, when January opened with a total of $71,451,000, following an unusually dull month. The offerings this month were large in number but small in volume, the largest single issue being the $10,500,000 issue of the Standard Gas & Electric Company, offered at 93½ and yielding 7 per cent. Long-term securities predominated, and the rate of return continued on the up-grade—6.52 as compared with 6.50 for December and 6.49 for November.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JANUARY

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Portsmouth Power Co., N. H.)	$500,000	..	Cumulative preferred stock	Pay off floating debt	7	96½	7.25
Saranac River Power Corp. (N. Y.)	300,000	14	First mortgage gold bonds	Construction	7	100	7
Standard Gas & Electric Co. (N. Y.)	10,500,000	30	Convertible gold debentures	Refunding and new capital	6½	93½	7
Kentucky Utilities Co	2,000,000	24	First mortgage lien gold bonds, series D	Additions and other corporate purposes	6½	98½	6.63
Androscoggin Electric Co. (Me.)	591,000	10	First and refunding mortgage gold bonds of 1914	Additions	5	90½	6.25
San Antonio Pub. Service Co. (Tex.)	1,750,000	28	First mortgage and refunding gold bonds, series A	Extensions	6	95	6.38
Los Angeles Gas & Electric Corp. (Cal.)	8,000,000	18	General and refunding mortgage gold bonds, series H	Refunding and to provide for extensions and additions	6	99	6.05
New York State Gas & Electric Corp.	2,350,000	38	First mortgage gold bonds	Additions	5½	92½	6
Southwestern Power & Light Co. (N. Y.)	1,400,000	..	Cumulative preferred stock	New capital	7	96½	7.25
Dominion Power & Transmission Co., Ltd. (Canada)	250,000	..	Cumulative preferred stock		7	99	7.07
Interstate Public Service Co. (Ind.)	2,750,000	25	First mortgage and refunding gold bonds series B	Refunding and other corporate purposes	6½	98	6.65
San Joaquin Light & Power Corp. (Cal.)	2,500,000	28	Unifying and refunding mortgage gold bonds, series B	Additions and other corporate purposes	6	99	6.05
Annapolis & Chesapeake Bay Power Co. (Md.)	800,000	24	First mortgage gold bonds, series A	Refunding and new capital	6	95	6.40
Blackstone Valley Gas & Electric Co. (R. I.)	906,000	15	First (closed) and general mortgage gold bonds of 1912	Construction and acquisition of stock	5	98½	5.12
Consumers' Power Co. (Iowa.)	300,000	10	First mortgage gold bonds, series A	Refunding and additions	6	96½	6½
Memphis Power & Light Co. (Tenn.)	97,000	..	Cumulative preferred stock		7	97	7.22
Potomac Edison Co. (Md.)	2,000,000	24	First mortgage and refunding gold bonds, series B	Construction	6½	97	6.75
Union Electric Light & Power Co. of Illinois	10,000,000	30	First mortgage gold bonds, series A	Construction	5½	95½	5.80
Virginian Power Co	5,000,000	30	First lien refunding mortgage gold bonds, series A	Extensions	6½	96½	6.75
Continental Gas & Electric Corp. (Neb.)	5,000,000	..	Prior preference stock	General corporate purposes and acquisition of controlling interest in other company	7	92½	7.57
Keystone Power Corp. (Pa.)	600,000	10	Convertible gold debentures	General corporate purposes	7	98	7.27
Total	$57,594,000						

Power Board's Jurisdiction

Indiana Senator Thinks It Can Be Made to Include All Streams in the Old Northwest

A PROPOSAL by Senator Ralston of Indiana that the jurisdiction of the Federal Power Commission be extended to include all streams in what formerly was the Northwest Territory was discussed at the meeting of the commission on January 25. The Indiana Senator contends that under an old act passed in the interest of the hunting and trapping industry of a century ago the commission can assume control over all streams capable of floating a canoe in the area north of the Ohio and east of the Mississippi, these streams having been proclaimed public highways. His purpose is to bring all water-power projects in this territory under the federal act and subject them to the recapture provision. No action on the matter was taken by the commission.

The commission is ready to support actively the amendments proposed by Executive Secretary Merrill to bring under the act plants operating under federal permits issued prior to its passage, to authorize the hiring of personnel instead of utilizing the services of employees borrowed from the War, Interior and Agricultural Departments, to give the commission authority to use the funds collected from licensees to apply on its operating expenses, and to co-ordinate under the commission various activities of the three departments just mentioned.

LICENSES AND PERMITS

The commission authorized the issuance of a license to cover the Tease Lake project on Speel River, Alaska. The Speel River Company has a 1,200-hp. development on Tease Lake for grinding pulp and plans to install an additional 300 hp. The site is capable of developing 7,000 hp., and the company applied for preliminary permits covering three other sites. These were rejected.

Licenses were also authorized for the Ocklawaha Reclamation Farms of Ocala, Fla., covering a 700-hp. project at the government dam at Moss Bluff, on the Ocklawaha River, and for the city of Tacoma, Wash., to cover the flooding of nine acres of public lands in the Olympic National Forest in connection with the large projects planned on the North Fork of the Skokomish River.

Preliminary permits were granted to the Winchester (Ky.) Water Works Company, for a power project at United States Lock and Dam No. 10 on the Kentucky River; to John L. Fish of Lakeside, Ariz., for a power project on Salt River, and to the Pigeon River Power Company of Waynesville, N. C., for a project contemplating the development of 60,000 hp. at a point near the Tennessee-North Carolina line, on condition that further investigations are to be made as to the feasibility of developing additional storage on the Hiawassee River above the proposed dam.

The preliminary permit of the Pit River Power Company, which expired December 31, was extended to March 3. The permit of the Hirst-Chichagof Mining Company of Seattle was extended to April 28, 1925. The permit of the California Oregon Power Company of San Francisco was amended so as to eliminate any participation in it of the Klamath-Shasta Irrigation District. At the request of the Southern Sierras Power Company of Riverside, Cal., the commission canceled its preliminary permit covering a proposed development on Whitewater River, now found not feasible.

An amendment of the commission's regulations was approved so that charges for the use of government lands and structures shall apply on the January 1 following the completion of the project, instead of on the January 1 following the date of the opening of operations.

The commission decided to exercise jurisdiction over the project of the Hydro-Electric Company, Telegraph Building, Harrisburg, Pa., which recently declared its intention of constructing two dams across Toms River just above Toms, N. J., and over the project of John A. Shafer, Indianapolis, which provides for the construction of an 18-ft. dam in the Wabash River, 6 miles below Logansport.

Italian Junior Engineers to Gain American Experience

Between two hundred and three hundred young Italian engineers are to have the advantage of practical experience in the United States as a result of efforts which have been put forth by Prince Gelasio Caetani, the Italian Ambassador at Washington. These young men, all of whom will have recently graduated from Italian engineering schools, will begin to arrive in groups of five or ten late in February.

Ambassador Caetani in his youth came to the United States to take a post-graduate course at Columbia University. Following the completion of his work at Columbia, he sought practical experience in the metal mines of the West, where he worked in various capacities from common laborer up, with the idea of preparing himself more thoroughly for the active practice of his profession of mining engineering. Later he opened offices in San Francisco and for some years was in active practice.

This experience proved so valuable to Prince Caetani that he suggested to a number of individual American manufacturers the desirability of giving subordinate places in their plants to a few graduates of Italian engineering schools. It is his opinion that Italy and the United States will benefit in about equal proportions. He estimates that half of the boys who come over will return to their country. They will take back an intimate knowledge of American practice and of American products used in connection with their particular line of activity. This will mean future orders for American manufacturers. The remaining 50 per cent of the young men, the Ambassador expects, will become permanent residents of the United States. Since they have been picked by a rigorous process of elimination, he believes their acquisition by this country will be an asset.

In addition to the co-operation of the Westinghouse Electric & Manufacturing Company, the General Electric Company and other manufacturers, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the American Engineering Council and other engineering societies are co-operating in finding places for the young men.

Briefer News

Wisconsin Chapter of Electrical Inspectors.—The third annual meeting of this body will be held in the City Hall, Eau Claire, on Feb. 19-21. Reports of standing committees and a number of addresses on practical subjects will make up a full program. A. C. Schultz, Wisconsin Inspection Bureau, Milwaukee, is secretary.

Quebec Contractor-Dealers Elect Officers.—At the annual meeting of the Electrical Contractor-Dealers' Association of the Province of Quebec, Inc., held at Montreal, these officers were elected: President, L. A. Mace; vice-president, W. Rochon; secretary, G. Brassart; treasurer, R. S. Muir.

Kentucky-Tennessee Takes Over Municipal Plant.—The municipal plant serving Irvine and Ravenna, Ky., under the name of the Kentucky River Utilities Company has been acquired and is now operated by the Kentucky-Tennessee Light & Power Company.

Emmet to Address New Englanders.—W. L. R. Emmet, consulting engineer General Electric Company, Schenectady, N. Y., will address the Technical Section of the New England Division of the National Electric Light Association at the Copley Plaza Hotel, Boston, February 11, upon "The Mercury Turbine." The meeting will start at 10:30 a.m. and will include a luncheon with provision for discussion of technical problems in the afternoon.

Cheap Rate for Electrochemical Power Proposed in Seattle.—Twenty-five dollars per kilowatt-year is the rate fixed for electrochemical power by the provisions of an ordinance introduced in the City Council of Seattle recently. Electrochemical power is construed to mean power used solely for the purpose of manufacturing chemical products by users whose minimum load is 1,000 hp. or more. The council has passed a bill fixing the rate for "waste power" at 1 mill per kilowatt-hour.

Industrial Preparedness as Insurance Against War.—The American Institute of Electrical Engineers is to participate with other engineering societies, in co-operation with the War Department, in a dinner to further industrial preparedness as insurance against war. This dinner will be held at the Hotel Commodore, New York, on Tuesday next, February 5, at 7 p.m. John J. Carty will

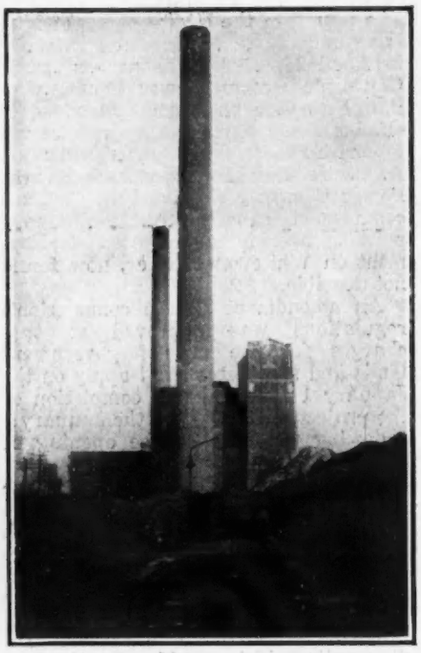
be one of the speakers, and E. W. Rice, Jr., F. B. Jewett, Gano Dunn, John W. Lieb and L. F. Morehouse are on the committee.

Illinois Company Closes Down Last Direct-Current Plant. — The Geneseo electric generating station of the Illinois Northern Utilities Company has been shut down and all loads transferred to the new incoming transmission lines. "Finis" is thus written on the operation of direct-current generating stations by this company, this being the last of about twenty-four isolated direct-current generating plants which have been shut down and superseded by transmission-line service.

General Electric Starts Course in Advanced Engineering. — An advanced course in engineering, intended primarily to give special training to men who have exceptional qualifications for designing engineering work, has been established for student engineers in the employ of the General Electric Company, according to a recent statement by F. C. Pratt, vice-president. The course will be under the direction of R. E. Doherty, a consulting engineer of the company, assisted by A. R. Stevenson, Jr. The number of students in the course during the first year will be limited to thirty, and this number will be reduced to about ten at the end of the first year.

Australia Makes Radio "Fans" Pay. —A method to turn the supply of radio programs into a commercial undertaking has been adopted by the Australian Commonwealth wireless authorities, says a report to the Department of Commerce from the United States Trade Commissioner at Melbourne. The regulations require that every prospective purchaser of a receiving set must present to the radio goods dealer a certificate of license showing that he has subscribed to the service of the station operating on the wave length to which the instrument being purchased is adjusted. If the radio enthusiast desires to "listen in" on additional programs, he can have his receiving set so adjusted, but only on the production of certificates showing that he has made separate subscriptions to each.

Customer Ownership Bill Filed in Massachusetts.—In response to a recommendation of the Massachusetts Department of Public Utilities, a bill has been filed in the Massachusetts Legislature providing that in cases where an increase of capital stock does not exceed 4 per cent of the existing stock of the company the directors, without first offering the shares to the stockholders, may sell them at auction or by tender to the highest bidder under certain terms, not less than par to be paid in cash as the directors shall determine, or may sell them to customers of the company upon such terms and conditions as may be approved by the department. Present legislation handicaps the direct sale of securities to customers in Massachusetts, and the commission has for some time manifested its sympathy with the customer-ownership program.



Dubuque Boasts a 275-Ft. Smokestack.—An addition to the plant of the Dubuque (Iowa) Electric Company costing more than $250,000 has recently been completed. Among the improvements is the tallest smokestack in the state. This stack, which is of concrete, is 275 ft. high and has a 24-ft. base. New generating equipment and still further extensions are planned for this station.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Society for Electrical Development—522 Fifth Ave., New York, Feb. 5. J. Smieton, Jr.

Commercial National Section, N. E. L. A.—Hotel Cleveland, Cleveland, Feb. 6-7.

New Mexico Public Utilities Association—Franciscan Hotel, Albuquerque, Feb. 18-20. C. E. Twogood, Albuquerque, N. M.

American Physical Society—New York, Feb. 23.

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 11-13. E. F. McKay, First National Bank Bldg., Oklahoma City.

Association of Electragists, Eastern Division—Hotel Astor, New York, March 18.

Illinois State Electric Association—Hotel Sherman, Springfield, Ill., March 26-27. R. V. Prather, Springfield, Ill.

American Institute of Electrical Engineers—Spring convention, Birmingham, Ala., April 7-11. F. L. Hutchinson, 33 West 39th St., New York.

Wisconsin Utilities Association—Hotel Pfister, Milwaukee, April 17-18. John N. Cadby, 445 Washington Bldg., Madison.

Southwestern Division, N. E. L. A.—New Orleans, April 22-25. S. J. Ballinger, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 22-25. E. N. Willis, Dallas, Tex.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. C. G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

Dr. Hull Lectures at University of Pennsylvania.—A series of five lectures on the vacuum tube and its applications was delivered in the Moore School of Electrical Engineering, University of Pennsylvania, by Dr. A. W. Hull, research engineer of the General Electric Company, last week. He discussed thermionic emission, the kenetron, space charge, the pliotron, the magnetron, the dynatron, photo-electric cells and gas-filled tubes.

Large and Small in Lamps.—What is probably the largest electric light bulb ever made—150,000 cp.—and the smallest, no larger than a grain of rice—were exhibited at the Sprague plant of the General Electric Company in East Orange, N. J., last week. The huge bulb, which was designed and made by George Bowerman, electrical engineer attached to the Edison Lamp Works at Harrison, N. J., is 22 in. high, and the top, which is ball-shaped, has a diameter of 15 in. The tiny bulb was the one recently inserted in the end of a glass tube which was placed in a child's throat in the successful attempt to locate and remove a swallowed tack. The giant lamp is rated at 30,000 watts.

Big Steam Generators for Long Beach.—Another step in the extension program of the Southern California Edison Company has been taken by ordering electrical equipment from the General Electric Company totaling nearly $1,500,000 in value for the new steam generating station planned for Long Beach. Included among the equipment ordered are two 35,000-kw. turbo-generator sets and auxiliary equipment. These will be the largest steam turbo-generators ever shipped west of the Mississippi River. The new equipment will bring the available capacity at this station to more than 100,000 kw. and the total capacity of all the Southern California Edison Company's generating plants to more than 400,000 hp.

French President Signs Decree to Promote Electrification.—Under date of December 13, 1923, the President of the French Republic signed a decree which constituted at the Ministry of Public Works a commission charged to proceed with the study of a general program of electrification of France aided by such administrative and financial means as may be necessary. This commission will be presided over by the president of the Superior Railway Council and will further comprise as vice-presidents the vice-president of the Electricity Committee, the Director of Hydraulic Power and Electric Distribution and the Director General of the Railways. The commission will be made up in equal numbers of members of the various ministries interested and of qualified representatives of such industries as are associated with the creation, transport and distribution of electrical energy. It will number forty.

Boulder Dam Bill.—The Boulder Canyon Dam bill, fathered at Washington by Senator Hiram Johnson and Representative Swing of San Bernadino, Cal., which authorizes the construction by the federal government of a dam at Boulder Canyon, in the Colorado River on the Nevada-Arizona border, to provide permanent flood protection for the Imperial Valley, the storage of sufficient water to irrigate more than a million acres of arid land in southern California and Arizona and a site for the generation of 600,000 hp. of hydroelectric energy, is to be amended by the addition of a section which, it is hoped, will remove any opposition on the part of the four northern Colorado River states. This new section will include virtually all the provisions for the division of water rights among the seven states concerned now written into the Colorado River compact, to which Arizona alone has withheld adherence. With this change advocates of the bill express confidence in its passage.

New 58,000-Hp. Unit Goes Into Service at Chippawa.—A new prime mover rated at 58,000 hp. went into operation recently at the Queenston-Chippawa power station on the Canadian side of Niagara Falls. This unit was built by the William Cramp & Sons Ship & Engine Building Company of Philadelphia for the Hydro-Electric Power Commission of Ontario. It is the sixth unit to be installed at this plant. The five others are rated at 55,000 hp. each, making the total present capacity at Chippawa 333,000 hp. Two additional units are now under construction by the Dominion Engineering Works, and it is expected that the commission will soon order two more, completing the station. The combined rating of the ten units will be 565,000 hp.

Two More Types of Electrically Equipped Vessels.—The first commercial, privately owned Diesel-electric hopper dredge on the Great Lakes will be put into operation by the Construction Materials Company of Chicago during the present year, orders having been placed with the General Electric Company for complete electrical equipment for such a boat. It will also be used for transporting construction materials for building. An electrically driven towboat which may, it is said, revolutionize inland waterways communication is being tested by the United States government on the Warrior River above Tuscaloosa, Ala. Power is furnished by two six-cylinder Diesel engines driving 90-kw. generators which operate a motor capable of developing 200 hp.

New Ten-Million-Dollar Steam Plant Projected for Southern California.—A steam-driven electric generating plant that will upon its completion be one of the largest in the West has been announced by the Los Angeles Gas & Electric Corporation as one of its projects in the immediate future. The plant, which will be built at Seal Beach, Cal., 5 miles south of Long Beach, will cost approximately $10,000,000. This announcement came a short time after the company's purchase of an 8-acre site on the east side of the Alamitos Bay inlet for $200,000. Plans for the present year call for the expenditure of $3,500,000 to erect housing capacity for two Westinghouse turbine units each rated at 48,000 hp. and to install one of them. When the entire plant is completed it will have a capacity of 288,000 hp.

Fixture Market at Chicago Sounds Slogan.—"Notice the lighting equipment," the slogan of the lighting-fixture industry, was much advertised at the fixture market held at the Hotel Sherman, Chicago, January 21-26. The application of interior decorating principles to correct lighting was discussed by Lionel Robertson, Chicago, who showed examples of blending fixtures to period furniture. W. L. Goodwin, Society for Electrical Development, spoke of the growth and development of the electrical home movement and outlined its benefits to the entire industry. He explained a proposed essay-writing contest for school children on the merits and faults of the lighting equipment in their own homes, a grand prize of a fifteen-thousand-dollar electrical home being contemplated. C. H. Hofrichter, Cleveland, condemned the practice of selling fixtures instead of illumination equipment. This mistake, he thought, was partly responsible for the slow development of the fixture business as compared with other branches of the electrical industry.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Samuel D. Heed, New Vice-President in Cincinnati

Samuel D. Heed, who was recently elected a vice-president in charge of public relations of the Union Gas & Electric Company, Cincinnati, a subsidiary of the Columbia Gas & Electric Company of New York City, as was announced in the January 26 issue

S. D. HEED

of the ELECTRICAL WORLD, has served as general manager of the company for the past three years. After being graduated from Swarthmore College Mr. Heed became identified with the Philadelphia & Westchester Traction Company and later with the Pennsylvania Railroad in New York. Subsequently he joined the sales force of the Hess-Bright Company, New York, but severed his connection to become resident engineer on the construction of the Hell Gate bridge.

John E. Zimmermann of Day & Zimmermann, engineers of Philadelphia, has been elected president of the Edison Light & Power Company, York, Pa., and of the company which controls it, the York Railways Company, succeeding Gordon Campbell. Mr. Zimmermann is also succeeding Mr. Campbell as president of the York Steam Heating Company, the York Suburban Land Company and the York Transit Company, other subsidiaries of the York Railways Company. Mr. Campbell has relinquished the duties of these offices after many years of service to devote himself to the solution of public utility problems in a broader way.

Henry P. Broughton, who has been commercial manager of the light and power department of the Indiana Service Corporation, Fort Wayne, Ind., for the past three years, has resigned. Mr. Broughton has not made known his definite plans for the future but it is believed that he will engage in a different line of work in the electrical field. Before joining the Indiana Service Corporation, he was manager of the Interstate Public Service Company, Kentland, Ind.

Samuel B. Tuell, formerly district manager of the Houghton County (Mich.) Electric Light Company and Houghton County Traction Company, has been made district manager of the Middle West companies of the Stone & Webster organization, succeeding David Daly, recently elected president of the Blackstone Valley Gas & Electric Company. The Middle West companies include the Mississippi River Power Company, Keokuk (Iowa) Electric Company, Fort Madison (Iowa) Electric Company, Paducah (Ky.) Electric Company, Houghton County Electric Light Company and Houghton County Traction Company.

David Daly, formerly district manager of the Middle West group of properties under Stone & Webster executive management, has been elected president of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I. Mr. Daly, a native of Boston and a graduate of Harvard, has been associated with the Stone & Webster organization for the past twenty-four years, having served in various capacities in the Boston

office, at Ponce, P. R., Houston, Tex., and, until his recent promotion, in Keokuk, Iowa, where he has been district manager of the Middle West properties since 1919.

Espy and Argabrite Vice-Presidents of A. G. & E. Company

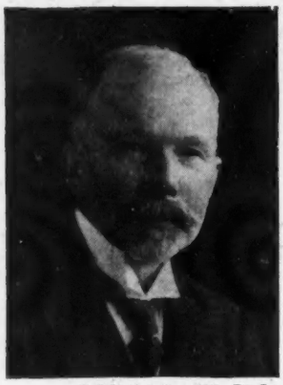
Frank Espy, general manager of the Ohio Power Company, Canton, Ohio, a subsidiary of the American Gas & Electric Company, and N. M. Argabrite, in charge of the valuation department of the parent company in New York, have recently been made vice-presidents of the A. G. & E. Company. The promotion of Mr. Espy brings him back to the home office of the American Gas & Electric Company, where six years ago he spent a year as assistant to the general manager. Then, after serving as general manager of the Atlantic City (N. J.) Electric Company for two years, he returned to Ohio, where he had been identified with A. G. & E. properties before coming East, and since that time has been in charge of the company's subsidiaries in that state.

Mr. Argabrite's first connection with the industry was with the Ohio Valley Electric Railway Company, Ashland, Ky., as assistant superintendent of construction. Subsequently he went to Winona, Minn., where he became superintendent of the railway department of the Winona Railway & Light Company, later being promoted to be general superintendent of the entire company and afterward to the office of general manager covering railway, electric and heating property. From there he went to Belvidere, Ill., in the capacity of general manager of the Electric Gas & Hot Water Heating Company, but in 1910 severed his connection there to join the Hartford City (Ind.) Lighting Company, a property of the American Gas & Electric Company. Mr. Argabrite served in the Elwood and Muncie offices before coming to New York, where he was placed in charge of the valuation department.

Sir William Noble, Engineer

Sir William Noble, formerly engineer in chief of the Post Office, London, was born in Aberdeen, Scotland, in 1861 and was educated at Gordon College in that city. After serving for about five years in the capacity of Post Office engineer in the northeast of Scotland, he was transferred to the headquarters of the engineering department of the Post Office in London in 1897. At first he occupied the position of first-class engineer, but subsequently was made technical officer and later first-class staff engineer at headquarters. Not long after this Sir William was promoted to be superintending engineer of the London district and then assistant engineer in chief, and afterward he was appointed to the office from which he retired in 1922, engineer in chief of the Post Office. At the present time he is a director of the General Electric Company, of the British Broadcasting Company and of the Walker-Weston Reinforced Concrete Road Company.

Sir William was made a Chevalier de la Couronne de Belgique in 1919 and one year later was knighted by the King of England. He has contributed numerous articles to the technical press on telephones, telegraphs and wireless.



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SIR WILLIAM NOBLE

Robert L. Fitzgerald has been made manager of the light and power department of the Indiana Service Corporation, Fort Wayne, Ind., succeeding Henry P. Broughton, recently resigned. He was formerly associated with the Gary (Ind.) Heat, Light & Water Company, the engineering staff of the Wisconsin Railroad and Tax Commission, and with R. M. Feustel, consulting engineer. Within the past two years Mr. Fitzgerald has been engaged in making engineering investigations and reports on public service properties for the American Electric Power Company, Philadelphia; the Consolidated Power & Light Company, Huntington, W. Va., and for Tucker, Anthony & Company.

Obituary

Charles H. Stone, director of the chemical laboratory of the Rochester Gas & Electric Corporation for the last five years, died on Sunday, January 27, from the effects of an operation performed the previous week. Mr. Stone was formerly connected with the United State Geological Survey at Berkeley, Cal., and later with the Public Service Commission of Massachusetts. He was forty-seven years of age.

Arthur J. Meyer, assistant secretary and treasurer of the People's Gas & Electric Company, Wapello, Iowa, died of pneumonia on Sunday, January 20, after an illness of less than a week. In addition to his connection at Wapello, Mr. Meyer was secretary of several affiliated companies and auditor for all the Walsh interests, which include the property at Wapello.

Edward Sawyer, president of the Atlantic Insulated Wire & Cable Company, Stamford, Conn., died suddenly on January 21, at Jekyll Island, Georgia, where he had recently gone on a vacation. Mr. Sawyer was born at Dover, N. H., forty-nine years ago, and after preparatory study at Andover entered Yale College, from which he was graduated in 1898. He was first connected in business with the American Trading Company of New York and later organized and became president of the Atlantic company.

James F. Cleary, an engineer in the betterment division of Stone & Webster, Inc., Boston, died on January 20 at his home near that city. Mr. Cleary was active in power-plant improvement work.

Brayton R. Clark, vice-president of the Malone Light & Power Company, Malone, N. Y., recently died.

Edward Dean, general superintendent of the Century Electric Company, St. Louis, for the past eighteen years, died suddenly on Friday, January 25, as the result of being struck by a motorcycle. Mr. Dean, who was a native of Michigan, was fifty-seven years of age.

Cecil Glenwood Rice, manager of the associated bureaus which conducted the claim work of the Duquesne Light Company, the Pittsburgh Railways Company, the Philadelphia Company and affiliated corporations, died suddenly on January 3 of pneumonia. Mr. Rice, though a native of Fairmont, W. Va., went to Pittsburgh after leaving school and engaged in newspaper work there. In 1909 he became superintendent of the claim department of the Duquesne Light Company and the Pittsburgh Railways Company, later being made assistant to President Callery. It was Mr. Rice who organized the associated bureaus which conducted the claim work of the related public utility companies. He was a member of the National Electric Light Association, American Electric Railway Association, American Society of Safety Engineers and of many other bodies.

Dr. Ralph Chapman Rodgers, assistant secretary of the Illuminating Engineering Society, died recently at his home in New York City as the result of an attack of acute indigestion. He had been taken seriously ill with ptomaine poisoning late in December, but had recovered sufficiently to be able to go to his office for a few hours each day. It was while in his office that he became suddenly ill, was removed to his home and died shortly afterward. Dr. Rodgers, a native of Binghamton, N. Y., and a graduate of Cornell University, served for fifteen years in that university's department of physics. In 1921 he left Ithaca to fill the office he occupied at the time of his death. He was a member of the American Institute of Electrical Engineers, the American Physical Society and the American Association for the Advancement of Science.

Marion M. McMillin, first vice-president and director of the American Light & Traction Company and a member of the firm of Emerson McMillin & Company, investment bankers of New York, died on Friday, January 25, at his home there, after a short illness. Mr. McMillin was also an officer and director in many other large corporations, including the Southern Light & Traction Company and the Consolidated Gas Company of New Jersey.

Commission Rulings

Line Between "Neighborly Accommodation" and Conduct of Small Utility. — The Public Service Commission of Montana has ruled that a small Delco electric plant installed in a hotel and supplying a few houses as well as the railroad station and post office at Armstead, a rural hamlet, with light is a public utility within the meaning of the law and "has gone far beyond the ordinary case of 'neighborly accommodation' which will not admit of the characterization of public service." The commission said: "The capacity of defendant's plant is not determinative. There are physical limits to all of the public services rendered in this country, and it is only within the area or territories actually served, or intended to be served, that service can be compelled. That the plant may be small, the area served of no great extent and the customers few is immaterial, and, of course, if the decision turned on the finding of an express profession of service, most of the businesses now regulated in this country as public businesses would present violent disclaimers of an intention to serve."

Responsibility of Commission to the Public in Granting Certificates of Convenience and Necessity. — In granting to the Alabama Power Company a certificate of convenience and necessity for a transmission line to Greenville, Ala., the Public Service Commission of that state said: "The question ought to be determined upon the basis of whether the rights, welfare and interest of the general public will be advanced, and not upon the private benefit or advantage that may accrue to any particular community. Whether the application is for authority to construct a new plant or to make an extension of an existing system not in the usual course of business, the burden is upon the applicant to show that there is a reasonable guaranty of sufficient business to warrant to the public a successful operation of a permanent utility enterprise, and, in the case of an extension of an existing system, that the permission thereof will not cast an undue burden upon present or future customers of the utility. It is true that it has been held by some commissions that where the application for a certificate of convenience and necessity is sought for the establishment of a new utility, the question whether such new utility can be operated at a profit is not involved, this being considered a risk undertaken by the applicant. We do not think such holding would be correct under the statute governing this commission. Under our statute we are of the opinion that in this respect a rule similar to that applied by the Illinois commission should obtain, namely, that the applicant should have such a reasonable guaranty of sufficient business to warrant to the public a successful operation of the undertaking as a permanent enterprise."

"Fifty-fifty" Stock and Bond Capitalization Favored. — In granting permission to the New Hampshire Power Company to acquire a number of smaller operating companies, as reported lately in "News of the Industry," the New Hampshire Public Service Commission emphasized the desirability of a much larger proportion of stock financing. Although the authorized bond issue is not much larger than prevails in many companies of this kind, a much better arrangement exists, the commission says, where the bonds do not exceed 50 per cent of the total value of the property. "In the future," the decision states, "we shall strive to have the company conform more closely at least to this 'fifty-fifty' basis, and we certainly shall hesitate a long time before we permit the company to do its financing by putting out bonds to the extent of 80 per cent of the cost of the improvements and betterments, which, as is alleged in the petition, the contemplated terms of the proposed mortgage will permit it to do." In the final report of the commission a value will be found for the property of each of the companies taken over. The power company will be required to put into effect in each of the communities served rates that will give a fair return upon the values so found. In this way each community will be required to bear its own burden.

Recent Court Decisions

Complaint in Damage Suit Must Allege Negligence or Facts from Which It Could Be Inferred.—In Simons vs. Pacific Gas & Electric Company damages were sought for the death of a man who was removing pipe from a well and was killed by electricity jumping from defendant's nearby wires to the pipe and thence passing through the victim's body. The District Court of Appeal in California found a judgment properly rendered for the company since the complaint did not allege negligence or facts from which it could be inferred. The court declared that it was not negligence *per se* for a company to erect its power line with leaning poles, nor to string wires at a height of 28 ft. 10 in. from the ground, nor to maintain its line within 7½ ft. of the well and derrick on which decedent was working, and that therefore a complaint alleging that the power line was so erected and allowed to lean and that it encroached on decedent's land did not exclude any hypothesis other than that of negligence. (220 Pac. 425.)*

Utility Must Not Collect from Users Consideration Paid City for Surrender of Reservations in Duplicate Franchise. —When a public utility, as the result of the purchase by it of a competing utility, found that it had duplicate equipment by reason of the consolidation of the two systems, and, in order to be able to remove or dispose of such duplicate equipment, entered into a contract with the municipality in which the municipality, for a stated consideration, surrendered all its rights reserved in a franchise under which one of the systems was constructed, among which was a right to purchase the system constructed under such franchise, thereby enabling the utility to remove such duplicate equipment, the utility is the beneficiary of the contract, and an order of the utilities commission directing that the consideration to be paid, under the contract, to the municipality be collected by the utility from its users in the municipality is beyond the power of the commission and is void. So holding, the Supreme Court of Idaho, in Boise City vs. Idaho Power Company, annulled an order of the Public Utilities Commission of Idaho which permitted the company to collect by increased rates to consumers the consideration paid by it to Boise City for the cancellation of a contract between the city and the Beaver River Power Company, the latter having been absorbed by the Idaho Power Company. (220 Pac. 483.)

Special Master Holds Dollar Gas Confiscatory.—The "dollar-gas" law passed by the New York Legislature last year has been found confiscatory by the special master appointed by the United States District Court to hear testimony in an action brought by the New York & Queens Gas Company against the Public Service Commission and the Attorney-General of the state. The bill provided that $1 per 1,000 cu.ft. should be the maximum charge for gas in New York City, that a standard of 650 B.t.u. should be maintained and that service charges should be abolished. The master upheld the right of the Legislature to fix the standard, with reasonable time for compliance, and abolish the service charge.

Second Enforced Valuation Examination Within Few Months Unconstitutional Where No Change in Property Has Occurred.—In line with previous judicial decisions in Alabama to the same effect, the United States District Court in that state, in granting a permanent injunction to the Mobile Gas Company against rates fixed by the Alabama Public Service Commission and held to be confiscatory (Mobile Gas Company vs. Patterson), made the declaration that where the commission had examined the books and records of a company for the purpose of making a valuation of its property, to require the company to produce its books and records for a second examination within a few months thereafter for the purpose of repudiating its former valuation was an abuse of power by the commission and an unreasonable search in violation of the national and state constitutions, although future examination when changes in the company's property occur is permissible. The first examination, the court held, created a contract fixing a permanent basic valuation binding on the state, and if the state desired to repudiate it, it would have first to return the money paid by the company to cover the expense of the search. (293 Fed. 208.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, New Equipment Available, Foreign and Construction News

Strengthening the Market for Industrial Electric Heating Equipment

Industrial Heating Still in the Development Stage —Application, Study and the Giving of Satisfaction Are Vital to Progress in Market Building

By C. I. Hayes
Manufacturer of Industrial Electric Heating Apparatus, Providence, R. I.

AN INTELLIGENT square deal to the customer lies at the foundation of success in developing, marketing and servicing electrical equipment for industrial heating uses. I have been asked by the ELECTRICAL WORLD to make a few suggestions as to ways of improving relations between manufacturers, sales representatives and purchasers in this rapidly expanding field, and the key to the situation will be found, I believe, in the first seven words of this paragraph. If we proceed along this line, remarkable progress will be realized in applying a class of electrical equipment to the solution of manufacturing problems in ways that frequently cannot be approached by any other means.

Still Developing

Broadly speaking, industrial electric heating equipment is still far from staple merchandise. There are now many applications of electric heating, like soldering, glue melting, sterilizing and cooking, which have become sufficiently standardized to warrant the classification of apparatus as staple products; but when we get into the field of process development proper sales effort, and, indeed, the proper development of equipment, is a matter of thermal engineering, thorough economic analysis of conditions and performance, and careful follow-up attention after installation has been made. Changes in the materials available for industrial electric heating apparatus design are frequent; modifications of customers' manufacturing processes are every-day occurrences, and constant vigilance is necessary to insure the proper selection of methods of construction and application that will keep initial costs within reason and make every installation warranted by the conditions a permanent asset to the purchaser.

The time is coming when this kind of equipment will attain a "mass production" basis, but it is not yet. We are still in the stage of equipment development, although much apparatus now in service is giving very efficient and thoroughly reliable performance. Given sound engineering analysis and reputable construction, the art can be said to have passed far beyond the experimental stage and to have become commercialized in a vast number of applications. Insulating materials are well-developed and so are electric heating elements, but the expiration of the Marsh patents has been followed by the entrance into this field of not a few apparatus makers lacking experience, and in some cases the cost to the customer has been far in excess of what should be the case, owing to ignorance of what is possible in design and construction, to hasty analyses of requirements and to failure in adequate servicing.

Every installation should follow thorough technical study of the requirements. We maintain a store in Providence with window displays of industrial heating equipment, but we do not expect customers to pick out their purchases through glass, have them tied up in bundles and carry them away without our making sure that the apparatus selected appears adapted to their needs. A few staple articles might move in this way, but not an oven, a furnace or other equipment involving application engineering in its successful service. The practice of insisting upon thirty days' trial of equipment is a vital feature of its success, and other manufacturers who follow this practice deserve credit for their stabilizing influence upon the business side of this interesting, promising and attractive class of electrical service. Unfortunately, in some cases purchasers of heating equipment in this country have not received the engineering attention which was their due, and misfit applications, failure to state frankly the best means of heating for a particular case, whether coal, gas, oil or electricity, poor construction and entire loss of interest in the customer's problems after the equipment has been paid for are responsible for troubles that never need have scarred the industry's record.

Application Study Vital

It is not too much to say that a personal interest should be taken in every customer's installation by the manufacturer's representative, and that, even if repeat orders are out of the question at the outset, the complete satisfaction of the purchaser is vital to the success of the heating branch of the electrical industry. Very careful attention must be given to the type of control equipment and instrumental installation provided, for the former is easily the most delicate part of the apparatus at present, and intelligent selection and certainly careful preliminary oversight must be had in the joint interest of the customer and the manufacturer. Amazing economies in operation and improvements in the quality of products often accompany the use of electric heating, but the suitability of this method must be thoroughly established and snap judgments avoided like a pestilence. The reputation of a poor job or of a failure travels fast and far, and while the "batting average" of the heating manufacturer is getting better every year, too much emphasis cannot be laid upon the wisdom of keeping in close touch with operating installations and studying them constantly to discern

the way toward still better designs and service.

The co-operative courses of the large manufacturers of electric heating equipment under the auspices of the National Electric Light Association have done much to increase the interest and knowledge of central-station power engineers in this field. There is room for further co-operation between these men, and the outlook is very encouraging all along the line for a greater appreciation of the limitations and possibilities of the heating market. Our resources in apparatus, developed and potential, are increasing steadily, and the reward of single-minded concentration upon the customer's interests will be a growth of electric heating uses that cannot now be conceived.

Blazing a New Trail

Some Particulars Concerning the Changes that Have Come of Late in the Lighting Equipment Industry—Organization and Co-operation of Distinct Benefit

BY HERMAN PLAUT
President National Council of Lighting Fixture Manufacturers

THE lighting equipment industry passed its zero hour not long ago when it organized itself under the leadership of the National Council of Lighting Fixture Manufacturers.

It was realized that the era of intense individualism was past, that the time for co-operation had come. To smoothe rough edges and corners the National Council established a conciliation board to arrange for the settlement of disputes among members. It guarded the rights of individual manufacturers by providing for a registration of designs. In that way it went far toward overcoming the silly practice of some manufacturers of stealing one another's designs. It encouraged cost accounting and better business practice generally.

STANDARDIZATION AND MARKET

Before the advent of the National Council the manufacturer of lighting devices had been a law unto himself as far as his business relations were concerned. The same thing held good in his factory, and this privilege of using all kinds of sizes in tubing, threads, etc., was most expensive, not only for himself and the people from whom he obtained his supplies, but also for the general public who bought his goods. To overcome this condition the National Council organized a standardization service. It was a most arduous task to clear these troubled waters, but years of expensive research work under competent direction have brought about remarkable progress and clarification. Four standardization bulletins have been issued so far, dealing respectively with proposed sizes for blown glass heels, proposed sizes for pressed-glass heels, fine threads for brass tubing, and models, gages and measuring tools.

The thoroughgoing and authoritative character of the standardization service is best attested by the fact that conclusions arrived at have been recognized and accepted as standards by those who are considered the highest authorities in this field. Among these are the United States Bureau of Standards, the United States Chamber of Commerce, the American Screw Thread Commission, the American Society of Mechanical Engineers, the Illuminating Engineering Society and the National Tap and Die Institute.

Then, too, there have been the annual markets, the fifth one of which, held in Chicago, has just closed. At these markets the members of the National Council have exhibited annually the products of their studios and plants, and they have extended the same privilege consistently and generously to others of the industry who are not members of this particular organization. Not only have these markets been the best kind of business builders; they have fostered outstandingly the spirit of fine fellowship and mutual sympathy that lay dormant within us. They have taught us very much to think as one.

MEETING OTHERS

So much for ourselves. Not that we have wanted to speak of ourselves first. We did so only because we wanted you to know that when we might talk about the splinter in the eye of our neighbor we had not been unmindful of the beam in our own eye and had taken steps to remove it or, at least, reduce its size.

The National Council discovered early in its life that, just as the individual manufacturer could in justice to himself no longer live according to the law of the jungle, neither could a group of these manufacturers stand aloof from the interests of all those other branches which together with it made up the great company interested industrially and professionally in artificial lighting. Just as the members of the National Council had learned that the lighting devices which they and their fathers had made had ceased to be "fixtures" and had become wonderfully flexible, so they discovered that it would neither be possible to remain indifferent to the weal or woe of other phases of this great field.

And in looking at these other fellows with whom they were rubbing elbows they found delightful congeniality and a splendid community of interests. It was a joy to lend a hand and help. It left a fine glow of fellowship that was surpassed only by the gratitude felt by us when the National Council encountered the fraternal grip extended to it in return by others.

It was thus a pleasure to encounter the high vision among leading distributors of lighting equipment who were keeping alive among their members against such great odds the spark of idealism and fanning it into flame in their own organization, which is now the National Association of Lighting Equipment Dealers. It was a pleasure to affiliate with manufacturers of illuminating glassware, those in and outside their own Illuminating Glassware Guild.

We delight in having a standing committee on contact with architects through whom very interesting connection has been made with the American Institute of Architects and their affiliations. We also have a representative at the meetings of the Illuminating Engineering Society and the Joint Committee of Business Development.

Again and again have we found that, with so much in common, it was simply a shame not to pool these interests occasionally and do a job for the associated lighting industries. We could do it well without in the least relinquishing what was distinctively ours or asking others to do this.

Had we needed an object lesson in that, it was conclusively furnished to us last year. The fertile mind of

our secretary, Charles H. Hofrichter, had projected the idea of calling the attention of people to lighting equipment. The plan was, and is, to arouse a public consciousness of lighting equipment, get people to "notice the lighting equipment."

But there is one thing I do want to point out. The "notice the lighting equipment" movement has proved that there is a community of interest among all those who are concerned with the use of electricity for lighting purposes. Central stations, the manufacturers of wire and wiring devices as well as those who install them, the manufacturers of lamps and illuminating glassware, the makers of parts and they who supply raw materials to those who manufacture lighting devices, whether these be of the fixed type, wall and ceiling, or portable, as well as all those who distribute or sell any of this—all of this vast company can and have found it possible and profitable to call upon people to "notice the lighting equipment," and in this way their natural community of interest has become apparent.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

A SOMEWHAT uneventful week in the electrical trade has been marked by several interesting incidents. A general reduction in lamp prices approximating 7½ per cent was announced this week and is expected to have a good influence on the development of the lighting market, so actively supported at this time. A prominent manufacturer of belt conveyors announced a price reduction of nearly 12 per cent. An important manufacturer of radio sets put out an entire new line at new prices. These units are all equipped with dry batteries. A small reduction in wire was also made by an influential manufacturer, but is considered more an adjustment to the market than an indication of a downward trend. Washington has announced complete electrical exports for 1923, showing an increase of more than $9,000,000 over the year previous. There has been an appreciable improvement in the demand for motors for the textile industry.

The weather continues to favor the electrical industry by permitting the steady continuance of central-station extension activities and building construction and by generally stimulating diversified buying. Reports from the Southeast show a growing activity in railroad and power company expansion that is already inducing a very brisk market for electrical materials.

Transmission Tower Flurry Caused by Milliken Patent

A SITUATION has developed in the steel transmission-tower field which is causing a little flurry among manufacturers of steel towers and among those users who have learned of it. The question is what effect, if any, there will be on price or availability of towers of a certain general design as a result of discovery of claim 5 in the Foster-Milliken patent No. 923,557 for a "tower or pole," granted June 1, 1909. This claim reads:

"A structural steel pole having a pyramidal pedestal portion, a tower portion carried by the pedestal portion, of approximately uniform cross-sectional area, and cross-arms arranged at intervals of the tower portion of the pole, of expanded width at the center and having diagonal braces reinforcing the tower."

Attorneys for Mr. Milliken have been inquiring among all manufacturers and among some users to find out what towers of this design have been built by them since 1909 and also what are now contemplated. So far as can be learned no suits have been prosecuted to a conclusion before a court, but it is reported that two or three manufacturers settled with Mr. Milliken outside of court after suit had been started or threatened.

Users point out that this type of pole has been generally accepted, wherever used, as a free design, and those who have gone into the question are strongly of the impression that this design was used prior to the filing of the application in February, 1908. Whatever the situation, these users point out, it is in the interest of the entire industry that the exact standing of this patent be determined so that uncertainty may not act to delay or otherwise affect the building of any transmission lines.

Construction Still Active in New England—Market Good

BARRING occasional uneven days, the demand for electrical supplies continues in about the same volume as that of the past fortnight. Open road conditions and long-continued mild weather with the exception of two recent short-lived cold waves have stimulated diversified buying. The demand for pole-line hardware is surprisingly good for this season, and central stations are planning vigorous line-extension work.

Deliveries on porcelain insulators for 6,600 volts and above are too long for the satisfaction of many buyers, running from eight to twelve weeks in many cases. Wiring devices are in fair demand, but the 1924 building season has not yet had much effect on purchases, orders being largely confined to jobs previously started and pushed toward completion. The market for heavy apparatus and cable continues excellent.

General business in New England is fairly good outside the textile and rubber-shoe fields. Some central-station companies are giving thought to the erection of general service buildings, with improved facilities for meter departments and other branches obliged in the past to get along with makeshift facilities.

Building Still Brisk on Pacific Coast—Ordering Improved

BUILDING conditions on the Pacific Coast continue to be very active. General ordering has improved after a cautious fortnight, resulting in a strengthening of the market for electrical materials. Rigid iron conduit has increased about 5 per cent, and dealers report that their store business has considerably improved, particularly in the outlying city districts.

The long drought from which this section had been suffering and which without doubt had caused the poor country business was very much relieved by a welcome rainfall. This year has been the second driest in Californian history, but none the less there has been much new 1923 dam construction by the power companies. Power companies' orders are, however, still small and continue to consist chiefly of maintenance hardware. Comparatively little extension work is being projected at this moment, although a good year is expected as the requisitions on file in new-business departments are constantly increasing.

Railroad and Power Company Business Good in Southeast

SEVERAL of the large railroads in the Southeast are preparing to make sweeping improvements in their shops, one of the roads having already begun the construction of a large additional unit for its Birmingham plant. This particular improvement contemplates the installation of complete electrical shop equipment and the electrification of all apparatus in the old unit that is now mechanically driven.

As a forerunner of increased power facilities the Central Georgia Power Company has purchased equipment for the installation of a 10,000-kw. steam-turbine auxiliary plant. This additional capacity will, of course, call for the purchase of considerable additional plant, line and transformer equipment.

The execution of extension and improvement plans of the Southeastern power companies, which in Georgia alone amounts to approximately $20,000,000, has opened up a brisk market for high-tension line material, outdoor switching equipment and transformers of the 110,000-volt type, the latter of which are offered only on very long shipment. The 11,000-volt to 38,000-volt transformer equipment is also becoming quite active, with shipments ranging from six to eighteen weeks.

Taken as a whole, the turbine business in the Southeast section has been

satisfactory, and manufacturers are no longer in a position to offer anything like prompt deliveries. Orders for switchboards of both the power-plant and industrial-plant types have been entirely satisfactory, with the outlook indicative of a continued brisk movement throughout the spring.

Building Lines Moving Best in New York District

THERE was a general slowing down of business in the New York market this week as compared with December, although business on the whole is good. Radio is remarkably strong and the demand shows no indications of falling off. Building supply lines continue to hold up well and are the best-moving material at the present time. Stocks are good and there is no difficulty in obtaining material. Prices in general are firm and no increases are looked for.

One manufacturer has announced a reduction of approximately 12 per cent in portable belt conveyors and another manufacturer has reduced rubber-covered wire 2½ per cent. This reduction in wire does not indicate a downward movement as there is a rising market in cotton and copper. Other manufacturers are not expected to reduce wire prices as they say their present prices are in line with the reductions.

Industrial business is unusually good for this time of the year, when as a rule this class of business is quiet. Collections are excellent and some jobbers report them even better than usual. There is a tendency to tighten up on credits with various organizations cooperating to improve conditions.

New radio apparatus consisting of a line of sets ranging in price from $35 to $425 was announced to jobbers this week by a prominent manufacturer. All the new sets are equipped for operation with dry cells.

Active Ordering in Middle West—Prices Firm—Outlook Good

ACTIVE buying of most commodities was noticeable this week in Chicago electrical circles. Construction programs laid out last year are being completed and many large projects are being contracted for this year. Central-station purchases have been good. Several large construction orders and contracts were placed this week, together with quantities of pole-line hardware. Many manufacturers are contracting for as much steel as the respective vendors will accept. Conduit manufacturers have accepted a large volume of business this week. Up to the present time no advance in price has been announced.

Rubber-covered wire demand has been normal, and stocks are ample to meet the demand. Prices are firm. A large order for busbar copper was placed in Chicago this week. Cable deliveries are slow, running twenty-four to thirty weeks on some of the larger sizes. Sales of heaters are exceptionally noticeable owing to the recent periods of sharp cold weather.

The Metal Market

THE non-ferrous metal market experienced no wide price changes during the last week. There has been a cessation in the demand for copper, while the other metals have held steady with sales of about normal proportions.

NEW YORK METAL MARKET PRICES

	Jan. 23, 1924 Cents per Pound	Jan. 30, 1924 Cents per Pound
Copper, electrolytic	12⅛ to 12¼	12⅛ to 12¼
Lead, Am. S. & R. price	8.00	8.00
Antimony	10.25 to 10.50	10.50
Nickel, ingot	26 to 30	26 to 30
Zinc, spot	6.85	6.85
Tin, Straits	51.00	48.25
Aluminum, 98 to 99 per cent	27.50	27.50

Noteworthy Gain in Electrical Exports During 1923

THE total value of exports of electrical machinery, apparatus and supplies from the United States in 1923 was $72,158,241, as shown in the table below. This was a notable increase over 1922, being a gain of more than $9,000,000, or an average increase of approximately $750,000 per month.

VALUE OF ELECTRICAL EXPORTS FOR DECEMBER, 1923, AND FOR THE ENTIRE YEAR, COMPARED WITH CORRESPONDING PERIODS LAST YEAR

	December, 1922	December, 1923	Year 1922	Year 1923
Turbines	$98,569	$5,178	$1,719,714	$511,313
Generators:				
Direct-current:				
Under 500 kw.	54,471	48,687	544,505	788,300
500 kw. and over	59,801	4,180	989,996	753,100
Alternating-current:				
Under 2,000 kva.	29,000	13,369	196,820	127,590
2,000 kva. and over	252,785	53,282	1,398,094	1,284,047
Accessories and parts for generators	20,994	92,220	1,135,736	1,025,218
Self-contained lighting outfits	28,701	37,455	441,569	610,017
Batteries:				
Primary	91,319	87,479	1,083,085	1,272,619
Storage	133,300	174,103	1,473,560	2,344,232
Power transformers	247,103	384,466	4,158,756	3,195,240
Other transformers	78,011	68,301	747,366	760,268
Rectifiers, condensers, double-current and motor-generators, dynamotors, synchronous and other converters	63,585	160,313	1,367,008	999,039
Switchboard panels, except telephone	259,977	224,202	2,701,508	1,667,798
Switches and circuit breakers over 10 amp.	166,546	116,353	1,891,921	1,796,174
Fuses and fuse blocks	24,978	33,375	198,665	311,467
Watt-hour and other measuring meters	52,602	82,217	564,476	518,834
Volt, watt and ampere meters and other recording, indicating, and testing apparatus	141,322	107,523	876,453	1,027,080
Lightning arresters, choke coils, reactors and other protective devices	100,970	56,217	678,438	615,547
Motors under 1 hp.	77,059	116,325	772,433	1,727,646
Stationary motors 1 to 200 hp.	212,300	227,912	2,037,231	3,088,078
Stationary motors over 200 hp.	45,386	121,389	665,967	813,468
Railway motors	89,743	64,169	480,149	659,825
Electric locomotives:				
Railway	140,703	246,555	853,562	3,037,140
Mining and industrial	.....	5,323	224,645	277,227
Other motors	6,389	29,238	351,384	230,625
Rheostats, controllers and other starting and controlling equipment	159,949	200,400	920,118	1,751,707
Accessories and parts for motors	86,377	170,440	1,138,241	1,659,051
Electric fans	92,009	53,927	816,116	859,045
Electric lamps:				
Incandescent carbon-filament	8,927	7,523	62,393	61,742
Incandescent metal-filament	89,380	112,547	1,224,574	1,130,861
Other electric lamps	20,459	19,369	205,592	234,721
Flashlights	30,734	38,966	253,623	494,327
Searchlights and projectors	47,076	23,820	279,801	366,298
Motor-driven household devices	67,943	83,489	641,608	865,861
Domestic heating and cooking appliances	62,357	111,799	591,895	984,471
Industrial electric furnaces and ovens	4,792	7,943	237,850	214,068
Therapeutic apparatus and X-ray machines, galvanic and faradic batteries, etc.	46,625	76,117	585,987	870,639
Radio and wireless apparatus	165,236	335,308	2,897,799	3,448,112
Telegraph apparatus	56,677	39,202	316,299	690,112
Magneto telephones	*	5,194	*	196,330
Other telephones	376,955	99,696	4,391,498	405,887
Magneto switchboards	*	1,818	*	119,039
Other telephone switchboards	*	3,370	*	403,309
Railway signals, switches and attachments	140,778	53,194	685,227	733,537
Bells, buzzers, annunciators, and alarms	7,006	8,192	63,563	107,579
Spark plugs, magnetos and other ignition apparatus	129,537	209,002	1,092,931	1,695,167
Insulating material	113,355	131,994	889,381	1,435,545
Metal conduit, outlet and switch boxes	21,851	35,506	295,194	478,083
Sockets, receptacles and lighting switches	74,310	82,081	488,703	1,077,404
Other wiring supplies and fixtures	176,620	167,386	1,342,426	1,891,466
Other electrical apparatus not elsewhere specified	641,216	832,525	7,887,484	8,821,921
Globes and shades for lighting fixtures	45,736	32,078	440,997	468,114
Electrical glassware, except for lighting	25,027	17,728	172,890	184,276
Electrical porcelain	93,030	177,783	1,379,750	1,783,614
Electrical carbons, carbon brushes and electrodes	98,016	230,259	1,098,094	2,317,495
Insulated wire and cable (iron and steel)	24,906	48,622	377,927	686,613
Other manufactures of aluminum	53,579	142,786	925,256	1,167,128
Copper wire (bare)	135,065	255,960	1,875,480	1,972,800
Insulated copper wire and cables	175,728	209,233	1,982,093	3,140,027
Total	$5,741,880	$6,587,088	$63,118,831	$72,158,241

* Not separately stated prior to January 1, 1923.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

National Conduit Stockholders to Make Investigation

The stockholders' protective committee of the National Conduit & Cable Company, Inc., has sent out a letter to stockholders and bondholders of the company requesting their participation in an investigation of the sale of the company's assets on September 14, 1923, to the Anaconda Copper Mining Company.

The committee feels that there may have been certain irregularities in connection with the sale and that an investigation is necessary. Stock and bond holders are asked to give the committee the power of attorney and to subscribe to a fund to defray the necessary expenses.

Century Electric Company Increases Line

The Century Electric Company of St. Louis has announced that since Jan. 1, 1924, orders have been taken for two-phase and three-phase motors, type S-C, in sizes up to and including 50 hp. On orders for motors of 40 hp. and 50 hp. deliveries are promised for April 1, while on orders for motors from 15 hp. to 30 hp. deliveries are promised in thirty days.

This type of motor has been made by the company only in the smaller sizes, but the engineering department has been working for many months upon the designs for the larger sizes. An addition has recently been made to the factory in order that there may be space for the manufacture of the larger sizes of polyphase motors. It is expected that by March 31 there will be a fair stock of all sizes of this type.

Philco Battery Agents Named

Hoyle & Pullen, 120 Franklin Street, Worcester, Mass., have been appointed agents for the Philco diamond-grid storage battery, including batteries for transporation, radio, farm lighting and industrial service. Archie Pullen, manager of the firm, was lately assistant electrical engineer in the cable-testing laboratory of the American Steel & Wire Company, Worcester Works.

Trundle Engineering Company Organizes New Department

The George T. Trundle, Jr., Engineering Company, Cleveland, has organized a new department to be devoted to problems of power and fuel. The department is in charge of Prof. F. H. Vose, head of the department of mechanical engineering at the Case School of Applied Science, where for eleven years he has been specializing in practical power-plant engineering, economical use of fuel, utilization of waste heat and the application of waste-heat boilers. During the war Professor Vose was a consultant with the Fuel Administration. Previous to his coming to the Case School he was with the United States Bureau of Mines and Washington University.

Line Material Staff Holds Sales Conference

The Line Material Company held its annual sales convention, December 26 to December 30, at the Hotel Martin, Milwaukee. Most of the time was devoted to a round-table discussion of selling problems, the development and improvement of line material as made by the company, and progress and changes in methods of electrical transmission and distribution. Each salesman reported the particular characteristics of his territory.

Those in attendance were President W. D. Kyle, Vice-President L. E. Hendee, and Sales Manager K. M. Kline of New York City, H. J. Eslow of Boston, M. R. Hoffman of Bridgeport, L. A. Greff of New York, J. J. Desmond of Chicago, E. R. McCoy of Indianapolis, O. R. Gossman of Des Moines, D. H. Millar and C. M. Parsons of Kansas City, C. A. Moore of Charlotte, N. C., and I. W. Bolton of Milwaukee.

Incandescent Lamp Prices Again Reduced

The General Electric and Westinghouse companies on February 1 made further reductions, averaging 7½ per cent, in list prices on substantially all types and sizes of "Mazda B" and "Mazda C" lamps. This reduction, it is stated, has been made possible by the development of improved lamp-making machinery, and manufacturing methods, which have more than offset increase in cost of labor and materials.

In the last two years four reductions in prices have been made—one in April, 1922, representing approximately nine per cent; one in October 1922, of about eight per cent; one on May 1, 1923, of about ten per cent, and the present reduction, which represents about seven and one-half per cent. The total amount paid for large lamps by the public in 1923 was approximately a hundred million dollars.

Standard Electric Sales in New Location

By moving its office and warehouse from 105 West Monroe Street, Chicago, to 217 North Desplaines Street, the Standard Electric Sales Company increased floor capacity six times. According to H. E. Johnson, the president, the sales staff also has been increased by the addition of two new men. At the same time this company has become Western representative of the Grist Manufacturing Company of New Haven, manufacturer of lamps, and the Union Electric Company of New Jersey, manufacturer of fuses and porcelain sockets.

"Check Seal" Program of Pacific States Electric—Value of an Outlet to the Industry Is Shown

The "Check Seal" campaign of the Pacific States Electric Company for 1924 was announced by officials of the company at a meeting of interested electrical men recently held in San Francisco. The program is designed to raise the standard of appliances, wiring and wiring material in the territory in which the company operates, create more satisfactory relations between consumer and contractor-dealers and establish a fertile field for follow-up sales activity.

Starting in Los Angeles in 1921, the scope of the "Check Seal" program has been extended to cover California, Oregon, Washington, Nevada, Idaho and Arizona. The advertising program for this year includes 700 billboards in 107 Western cities and 109 newspapers throughout the territory, having a combined circulation of 1,527,420. The growth of the campaign is indicated by the fact that billboards were used in only thirty cities in 1923 and advertising appeared in but twenty-five newspapers.

In considering the business possibilities on the Pacific Coast during the next five years it was assumed that 21,000 buildings per month for California, Oregon and Washington was the normal rate of construction. On this basis building in 1920 was 68 per cent normal, in 1921 90 per cent normal, in 1922 5 per cent above normal, and in 1923 25 per cent above normal. It is estimated that at least five years of above normal construction will be required to make up for the accrued shortage during the war.

The average value of a residential outlet to all branches of the industry over a period of five years is estimated by this company to be $20.06, divided thus: Power company, $12.14; contractor-dealer (wiring and fixtures), $4.13; appliances, $3.79. The total for wiring, fixtures and appliances can be still further proportioned to the jobber, $5.28, and manufacturer, $4.23. As the average number of outlets per job increases the return to the power company per outlet will naturally be reduced, although it is hard to say just how much this reduction will be. By co-ordinated effort an average of nearly five outlets have been added to each job installed in a period of about two years. In 1921 the average number of outlets per job was 11.5, and in 1923 this average was increased to 16.2. An objective of twenty-five outlets per job is the goal set for 1928.

Anaconda Buys Davis-Daly Copper

The Anaconda Copper Mining Company and the Davis-Daly Copper Company have announced that they have completed negotiations and that the Davis-Daly Company has accepted the offer of Anaconda to buy all the property and assets of the Davis-Daly company for $3,000,000 in cash. The proposition will be submitted to the Davis-Daly stockholders, who must ratify and approve it before the purchase can become effective.

The Davis-Daly stockholders will hold a meeting on February 20, at which time the proposition will be submitted with the recommendation of the board of directors and officers of the company that it be accepted.

Westinghouse to Install Four Automatic Railway Substations

The Westinghouse Electric and Manufacturing Company has been awarded a contract by the United Railways & Electric Company for the installation of four automatic railway substations in the downtown district of Baltimore. The installation will require about a year to complete and will cost in excess of $500,000. This program is in advance of that attained by any other city in the country and is the largest single installation of automatic substations that has been made.

Oshkosh Manufacturing Company Changes Name

The Oshkosh Manufacturing Company, 412 South Main Street, Oshkosh, Wis., has changed its name to the Leach Company. This change does not affect the organization of the company. The reason for this change as explained by Elmer Leach, sales manager, is that since the organization is manufacturing concrete mixers known to the industry under the Leach name, it feels it best to use the same name for its line of construction tools. For identification purposes the name "Oshkosh" will still be imprinted on tools.

Business of International G. E. in 1923 Shows Small Increase

The International General Electric Company will show some improvement in its 1923 report over the previous year. Notable increases in bookings have been prevented owing to continued unsettled political and business conditions abroad. However, estimates for the year placed bookings at $21,800,000 compared with $21,500,000 in 1922.

The business of the International Company in North and South America last year made satisfactory progress over 1922, and this was mainly responsible for the increase in total business. In Europe, however, orders fell somewhat under the previous year.

The Educational Exhibition Company, manufacturer of electrical displays, Providence, has opened a New York store and display room at 200 Fifth Avenue.

The Reinforced Switch & Manufacturing Company, Pittsburgh, has appointed Edwin Elliott & Company sales representatives for eastern Pennsylvania, southern New Jersey and Delaware.

The Galvin Electric Manufacturing Company, St. Louis, has recently appointed I. Elkas, formerly with the Robbins & Myers Company, as branch manager of its Chicago sales district, with offices at 751 North Water Street. The company has also appointed L. D. Hatch, for ten years with the Century Electric Company, as branch manager of its New York sales district.

The United Electric Company, Canton, Ohio, has appointed A. O. Eagle district manager for the mountain region, with headquarters at Denver, for the distribution of Ohio vacuum cleaners.

The Remy Electric Company, Anderson, Ind., manufacturer of electrical equipment for automobile service, has acquired the local plant used by the defunct Arvac Manufacturing Company, manufacturer of mechanical equipment, and will remodel and improve the premises for a new plant. It totals about 85,000 sq.ft. of floor space, with adjoining land, to be used later for the erection of an addition.

James D. Sparks, Seattle agent for Universal electric appliances, recently stated that he finds that the new appliances brought out this year, including round waffle irons oven toasters, griddles and percolators, are meeting with a cordial reception and that prospects for a record-breaking year are splendid.

The American Switch Company, recently organized, which purchased the plant of the Lewis Electric Company in Minerva, Ohio, has elected E. F. Duquette president, Charles P. Wolfe vice-president and general manager, and C. B. Kramer, treasurer and sales manager. The plant, which is in Cleveland, has 23,000 sq.ft. of floor space and is entirely equipped.

The Link Belt Company, Chicago, has further reduced the price of its portable belt conveyor, a reduction which it claims has been made possible by increase in production and consequent lowering of costs.

The Boston Electric Heating Corporation, Boston, has purchased the electric heating department of the Boston Last Company and will continue to serve the industrial trade with this line. Donald B. Heath, general manager; Charles E. Lowell and H. L. Spooner continue with the new company. This corrects an item appearing in the issue of Jan. 19.

The Holtzer-Cabot Electric Company, 103 Armory Street, Boston, has filed plans and will commence the construction of a one-story addition to its plant which it is proposed to use as a pickling works.

The Federal Electric and Radio Corporation, Park Building, Pittsburgh, has commissioned John H. Phillips, architect, Fulton Building, to draw plans for its proposed local plant, to cost approximately $40,000. It is expected to ask for bids at an early date. John E. Mair heads the company.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Auto Earth Borer and Pole Derrick

The Four Wheel Drive Auto Company, Clintonville, Wis., is now manufacturing an earth-boring and pole-setting machine, which is mounted on a standard FWD chassis. Only three men are necessary to operate the machine, one to drive the truck and control the various gear shifts of the machine, one to operate the earth-boring machine and one ground man to assist the machine operator. The machine can also be used for pulling poles. The Western Electric Company is the sole distributor for this equipment.

Graphic Instruments.—A new graphic meter, type LR, has been developed by the Esterline-Angus Company, Indianapolis. The removable ink well and pen tube and greatly increased damping are the more important new features, although other minor improvements have been made.

Thermal Relay.—A thermal relay type TR for protecting electrical equipment against overheating has been developed by the Automatic Reclosing Circuit Breaker Company, Columbus, Ohio. The relay can be used either as "circuit-opening" or "circuit-closing," as desired, and is provided with a bracket for mounting it on the frame of the machine. The weight complete with mounting bracket is 4 lb. The standard type TR thermal relay is built to operate at 75 deg C. or 169 deg. F.

Welding Electrode Holder.—A new welding electrode holder has been placed on the market by the Gibb Instrument Company, Bay City, Mich. It is light in weight, being made of aluminum, has renewable copper jaws and is equipped with an exposed, quickly interchangeable spring. It is claimed that because of the outside cable connection, air-cooled fiber handle and high conductivity of the aluminum members it does not heat up to the point where the operator must discontinue its use to allow it to cool.

Display Illuminator.—A new reflector has just been developed by the Wheeler Reflector Company, Boston, for use as a display and automobile exhibit illuminator. It is known as the "Isolux" reflector.

New Trade Literature

SOLDERLESS CONNECTORS.—Dossert & Company, 242 West Forty-first Street, New York City, has issued a sixty-four-page catalog covering the "Dossert" solderless connectors for stranded and solid wires, rods and tubing. It also describes and illustrates the subject of putting together a "Dossert" joint.

TROLLEY EAR.—The Ohio Brass Company, Mansfield, Ohio, is distributing a folder covering its "O-B" trolley ear.

TURBINE BLOWERS.—"Wing Turbine Blower" is the title of bulletin No. 67 issued by the L. J. Wing Manufacturing Company, 352 West Thirteenth Street, New York City, which describes and illustrates the "Wing" blowers for use with hand-fired or stoker-fired boilers.

AIR COOLER.—Bulletin No. 1,216 issued by the Griscom-Russell Company, 50 West Street, New York City, covers its "U-Fin" air cooler to be used for cooling air from generator windings by the use of turbine condensate.

SWITCHBOARD INSTRUMENTS.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 400, covering its direct-current switchboard indicating instruments.

INDEPENDENT JET CONDENSERS.—The Nordberg Manufacturing Company, Milwaukee, has published bulletin No. 36, which describes and illustrates the "Nordberg" independent jet condensers.

SAFETY PANELS AND CABINETS.—The Crouse-Hinds Company, Syracuse, N. Y., is distributing a folder describing and illustrating the "Crouse-Hinds" safety panels and cabinets. The company has also issued a small booklet covering its condulets of the "FA" series.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in London, England (No. 8,941), for electrical accessories.

Purchase is desired in Auckland, Australia (No. 8,970), for parts for storage batteries.

An agency is desired in Paris, France (No. 8,998), for electrical appliances for farm use and for hydraulic machinery.

Purchase and agency is desired in Bilboa, Spain (No. 8,940), for electrical apparatus for heating rivets.

An agency is desired in Copenhagen, Denmark (No. 8,953), for electrical installation materials.

An agency is desired in Winnipeg, Manitoba, Canada (No. 8,945), for electrical supplies, such as motors, lamps and radio apparatus.

Purchase is desired in Utrecht, Netherlands (No. 8,990), for rectifier for changing storage batteries.

An agency is desired in Rio de Janeiro, Brazil (No. 8,981), for wires and cables, sockets, switches and radio-telephone receivers.

TENDERS FOR POWER PLANT FOR RAILWAYS IN CAPE TOWN, SOUTH AFRICA.—Tenders will be received by the South African Electricity Supply Commission, 84 Marshall Street, Johannesburg, South Africa, until March 8 for the establishment and working of a proposed undertaking for the supply of electricity to the railways in the neighborhood of Cape Town. Separate specifications can be obtained from the commission, Johannesburg, or from Merz & McLellan, consulting engineers, 32 Victoria Street, London, S.W.1., for each of the following sections: (1) Steel-frame building; (2) boiler-house equipment; (3) coal and ash-handling plant; (4) turbo-alternators; (5) condensing plant; (6) power-station switchgear; (7) substation switchgear; (8) transformers for step-up substation and power station; (9) substation equipment; (10) cables.

TRANSMISSION LINE FOR BRISBANE, AUSTRALIA.—The Metropolitan Water Supply and Sewerage Board, Brisbane, Australia, will receive tenders until March 11 for the erection of a high-tension aërial transmission line from Breakfast Creek to Luggage Point and for electrical equipment, pumps and auxiliaries.

TENDERS FOR ELECTRIC SYSTEMS IN VARIOUS MUNICIPALITIES IN EGYPT.—Tenders will be received by the Director-General, Section of Municipalities and Local Commissions, Savoy House, Cairo, Egypt, until March 1 for construction of a hydro-electric station and a transmission line in the town of Fayum. Tenders will be received also for the installation of electrical plants and systems as follows: At Benha until March 20; at Chebin el Kom until March 27; at Miniet el Kamh until April 3, and at Beni-Mazar until April 10.

New Incorporations

THE BAILEY (TEX.) LIGHT & POWER COMPANY has been incorporated by H. T. Weathers, Lee Weathers and others.

THE REFUGE LIGHT & POWER COMPANY, Harvey, La., has been chartered with a capital stock of $100,000. The officers are: A. B. Hagen, president; P. A. Boudreaux, secretary and treasurer.

THE ATTICA (IND.) ELECTRIC COMPANY has been incorporated with a capital stock of $500,000 to operate electric plants and electric railways. The incorporators are: John W. Robb and Chester M. Poor, both of Clinton, Ind.; Marshall V. Robb of Indianapolis, and W. B. Reed and Charles W. Zeigler, both of Attica.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME. — The Cumberland County Power & Light Company contemplates an extension to its plant at Knightsville, to cost about $1,250,000. The output will be increased by 10,000 kw.

RUTLAND, VT.—The Vermont Power Company, recently incorporated, will, it is reported, take over all the undeveloped real-estate holdings of the Hortonia Power Company, Rutland, in Tinmouth, Clarendon and West Rutland, known as the Tinmouth properties, and all the undeveloped real estate in Weybridge and New Haven known as the Weybridge properties.

LOWELL, MASS.—The Lowell Electric Light Corporation plans extensions in its system during 1924, including increasing the output of its electric generating plant.

SOMERSET, MASS.—The Montaup Electric Company has started preliminary work in connection with its proposed local electric plant, to cost about $5,000,000. Stone & Webster, Inc., 147 Milk Street, Boston, is engineer.

COS COB, CONN. — The Connecticut Light & Power Company has work under way on a local substation.

Middle Atlantic States

KINGS PARK, N. Y.—The State Hospital Commission, Albany, contemplates the construction of a power house and a new building at the local hospital, to cost $1,000,000, for which bids will be asked in the near future. S. W. Jones, Capitol Building, is architect.

NEW YORK, N. Y.—Bids will be taken at once by the Navy Purchasing Office, South and Whitehall Streets, for 100 storage-battery-testing outfits.

SCHENECTADY, N. Y.—The Adirondack Power & Light Company has issued $800,000 in bonds, part of the proceeds to be used for extensions, including a proposed power plant at Cranesville.

SCHENECTADY, N. Y.—The City Council is considering replacing the single-lamp standards on State Street with double-lamp standards. The street-lighting service is furnished by the Adirondack Power & Light Corporation.

ATLANTIC CITY, N. J.—The construction of a new substation in Ventnor Heights to extend its service in Ventnor Heights, Margate and Longport is under consideration by the Atlantic City Electric Company.

SOUTH AMBOY, N. J.—Steps have been taken by the City Council for the installation of a municipal electric plant.

TRENTON, N. J.—The Thomas Maddock's Sons Company, Ewing Street, has engaged W. E. S. Dyer, Land Title Building, Philadelphia, engineer, to prepare plans for its proposed plant and power house in Hamilton Township, to cost about $650,000.

ALLENTOWN, PA.—The Pennsylvania Power & Light Company has been granted permission to construct a hydro-electric plant on Wallenpaupack Creek in Wilsonville, to cost about $700,000. A transmission line will be erected on the Sunbury-Selinsgrove highway.

LEWISTON, PA.—Bids, it is reported, will soon be asked by the Pennsylvania Wire Glass Company, Pennsylvania Building, Pittsburgh, for its proposed local plant, with power house, to cost about $450,000. Frank W. Hayes is engineer for the company.

PHILADELPHIA, PA.—Plans are being prepared for the construction of a power plant at the University of Pennsylvania, on the Schuylkill River. The present station at Spruce and Thirty-fourth Streets will be removed to the new location. The cost is estimated at $100,000. McClellan & Junkerfeld, 45 William Street, New York City, are engineers.

WILLIAMSTOWN, PA.—The East Penn Electric Company has secured permission to take over the system of the Lykens Valley Light & Power Company. The property of the Washington Township Electric Light, Heat & Power Company will also be acquired and the two systems consolidated.

ANNAPOLIS, MD. — The Annapolis & Chesapeake Bay Power Company has issued $800,000 on bonds, part of the proceeds to be used for extensions.

SOUTH CHARLESTON, W. VA. — The Kanawha Valley Power Company has been organized to take over and consolidate the South Charleston Utilities Company and the Nitro Power Company. Extensions in the transmission system are under consideration.

RICHMOND, VA.—The Virginia Railway & Power Company contemplates an expenditure of about $1,300,000 for extensions and improvements to its system, the amount to be divided between the Richmond-Petersburg territory and the Norfolk-Portsmouth division.

SUFFOLK, VA.—Plans for the proposed local plant to be erected by the Planters Nut & Chocolate Company, to cost about $350,000, include a power house.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Feb. 14 for electric supplies, including 65 interphone control boxes, 200 jack boxes, etc. (Circular C. P. 16660-1).

WASHINGTON, D. C.—Bids will be received by the purchasing agent, Post Office Department, until Feb. 7, for twenty-seven battery-charging outfits; also, until Feb. 4, for ten 1-hp. motors for pick-up tables.

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, Munitions Building, until Feb. 5, for 4,015 ft. electric power cable and five reels. (Circular 24125).

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Feb. 5, for 25,000 ft. single-conductor cable (Schedule 1811); also, until Feb. 12, for 47,200 lb. electrodes for the Washington yard (Schedule 1824), and until Feb. 12 for one transformer for the Puget Sound navy yard (Schedule 1815).

WASHINGTON, D. C.—The Board of District Commissioners has approved a bill drafted by the House District committee providing for the construction by the government of two hydro-electric generating plants on the Potomac River, for local service, one to be built at Great Falls, to cost $18,600,000, and the other at the District Line, Chain Bridge, to cost $13,600,000. Three storage reservoirs will be built to cost about $13,000,000.

North Central States

BOYNE CITY, MICH.—Negotiations are under way by the General Engineering & Management Corporation, 141 Broadway, New York City, for the purchase of the property of the Boyne City Electric Company.

DETROIT, MICH.—The Public Lighting Commission has voted to defer the erection of the proposed municipal electric plant at the foot of Morrell Street until January, 1927. The cost is estimated at $8,000,000.

EDENVILLE, MICH.—Work, it is stated, will soon begin by the Wolverine Power Company on the construction of two dams, one to be located in Hay Township and the other at Dick's Forks in Secord Township.

CINCINNATI, OHIO.—The Union Gas & Electric Company has issued $4,254,000 in capital stock, part of the proceeds to be used for initial work at its proposed electric power plant on the Big Miami River, with ultimate cost of about $10,000,000.

CLEVELAND, OHIO. — The Cleveland Electric Illuminating Company is planning to erect a substation at Shaker Heights.

MINERAL CITY, OHIO.—The Hickory Mining Company contemplates building a power house at its proposed local brick-manufacturing plant.

LOUISVILLE, KY.—The Kentucky Utilities Company has acquired the properties of the Danville (Ky.) Light, Power & Traction Company, the Paris (Ky.) Gas & Electric Company and the Carlisle (Ky.) Electric Light & Power Company. A transmission line is to be erected to connect these communities with the transmission system of the Kentucky Utilities Company, which extends from the new Pineville plant to the Dix River plant now under construction. The Kentucky company will also erect a 33,000-volt transmission line to Cynthiana and plans to build a 33,000-volt line from Paris to Carlisle, a distance of 20 miles.

BLOOMINGTON, IND.—The date for receiving bids for improvements to waterworks has been extended from Jan. 29 to Feb. 19. For details see issue of Jan. 12.

INDIANAPOLIS, IND. — The Thiesing Veneer Company, Hardy and McCarty Streets, it is reported, is planning to rebuild its plants and power house, recently damaged by fire. The loss is estimated at about $50,000.

INDIANAPOLIS, IND. — The Indiana Electric Corporation is arranging a fund of $1,850,000, the proceeds to be used for extensions to substations on the Wabash River and Indianapolis and for miscellaneous line extensions, etc.

GALESBURG, ILL.—Arrangements have been made whereby all telephone wires will be placed in underground conduits within five years.

SPRINGFIELD, ILL. — The expansion program of the Illinois Power Company for 1924 includes additions in power plants and substations, to cost about $1,200,000, including a central substation at Eleventh and Jackson Streets.

HOLY CROSS, WIS.—The Eastern Iowa Electric Company, Dubuque, Iowa, has been granted a franchise to supply electrical service here. The company is erecting a transmission line from Luxemburg. Holy Cross has not a post office.

LA CROSSE, WIS.—The installation of new arc lamps in various parts of the city is under consideration by the City Council.

LANCASTER, WIS.—The City Council is considering propositions submitted by the Interstate Light & Power Company, McGregor, including the installation of electrically-operated pumps in the municipal waterworks pumping station to replace the present steam plant; to furnish electricity to operate the municipal rock quarry, and for the installation of an ornamental lighting system in the downtown section of the city, consisting of forty-four lamp posts mounted with 250-cp. tungsten lamps.

MANITOWOC, WIS.—Bids will be received by the City Council until Feb. 15 for equipment for the municipal electric light plant. An expenditure of $25,000 has been authorized for improvements to the system. A. H. Zander is city clerk.

MILWAUKEE, WIS.—The superintendent of buildings and bridges has recommended to the City Council the installation of electrically operated elevator equipment in the City Hall to replace the present system. The cost is estimated at $100,000.

RUSH LAKE, WIS. — The Rush Lake Light & Power Company is planning extensions into the rural districts to furnish service to farmers.

WEST BEND, WIS.—Plans are being considered by the City Council for installing a new ornamental lighting system in the business district to replace the cluster lamps now in use.

DULUTH, MINN. — Walter Whiteside, 404 Atlas Building, Tulsa, Okla., is organizing a company to construct and operate a hydro-electric power plant on the Cloquet River in this section.

MINNEAPOLIS, MINN.—The City Council has voted to install 300 additional street lamps in the various wards during 1924, most of which will probably be erected in outlying sections. Work on the installation of ornamental lamps on First Avenue North will begin as soon as the weather permits.

RED LAKE FALLS, MINN.—The local electric plant of the Red River Power Company is reported to have been destroyed by fire.

GREENFIELD, IOWA. — Three plans have been submitted by W. C. Schwab, electrical engineer, to the City Council for extensions to the municipal electric plant, to cost $25,000, $50,000 and $90,000 respectively. The third plan calls for a new power plant to be erected near the railroad station and the use of oil engines instead steam engines.

HAMBURG, IOWA.—The Iowa Service Company will erect a new substation and recondition its local distribution system.

OAKLAND, IOWA.—The Iowa Service Company will erect a new local substation.

PISGAH, IOWA.—The Council is considering the installation of an electric lighting system, to cost about $20,000.

UNDERWOOD, IOWA.—A special election will be held on Feb. 5 to vote on the proposal to issue $13,500 in bonds for a municipal electric lighting system.

CAMERON, MO. — Contract has been awarded by the Board of Public Works to the W. S. Barnes Agency of Kansas City for two 300-hp. and one 20-hp. oil engine and generators with accessories, to cost about $62,000, for the municipal light and water plant. A new power house will be built.

FAIR PLAY, MO.—A franchise has been granted to W. A. Whinrey, president, Sac River Light & Power Company, Humansville, to install an electric lighting system here.

RICH FOUNTAIN, MO.—Permission has been granted to Clark E. Jacoby and Eugene L. Williams by the Federal Power Commission to construct a power dam on the Gasconade River above the Rich Fountain bridge.

ST. JOSEPH MO.—Extensions and improvements contemplated by the St. Joseph Railway, Light, Heat & Power Company include building a high-tension line through the industrial district, covering 10 miles, to cost $50,000; 6 miles of distribution line in residential section, $65,000; installation of a coal-handling crane, motor-generator, boiler-room signal system, coal crusher and other plant improvements, to cost $200,000.

CARRINGTON, N. D. — The Midwest Power Company is considering the erection of a transmission line from Devils Lake to Carrington.

EXETER, NEB.—The Nebraska Gas & Electric Company will rebuild its local distribution system and change all appliances and motors for alternating current.

NORFOLK, NEB.—The Nebraska Gas & Electric Company, Omaha, will erect a 33,000-volt line to Pierce, a distance of 16 miles.

NORTH PLATTE, NEB.—The Northwestern Public Service Company has acquired the property of the North Platte Light & Power Company.

WALTHILL, NEB. — Plans are under way for the construction of a municipal electric plant, for which bids will be asked early in the spring. The Prince-Nixon Engineering Company, Peters Trust Building, Omaha, is engineer.

Southern States

BALFOUR, N. C.—Plans for the proposed plant to be erected for the Balfour Cotton Mills, Inc., to cost about $200,000, include a power house.

ROCKY MOUNT, N. C. — The City Council is considering calling an election to vote on the proposal to issue bonds for extensions to the municipal electric light plant.

TROY, N. C. — The Deep River Power & Light Company, formerly operating at Moncure, N. C., as the Moncure Manufacturing Company, is planning extensions in its plant and transmission lines. The company has recently increased its capital from $200,000 to $1,000,000.

WILSON, N. C.—Plans are being prepared by Gladding & Grantham for extendsions to the municipal electric light plant, to cost about $180,000.

SPARTANBURG, S. C.—The Hygeia Ice & Fuel Company contemplates enlarging its plant and equipping it throughout for electrical operation. The cost is estimated at $100,000.

BLAKELY, GA.—Plans are being considered by the Blakely Hardwood Lumber Company for rebuilding its mill and power plant, recently damaged by fire. The loss is estimated at about $100,000.

JACKSONVILLE, FLA.—Estimates have been submitted by the General Electric Company, Schenectady, for the installation of an ornamental lighting system on the new road to the beaches. The plans provide for 317 double lamps of 250 cp., to cost about $20,000.

SANFORD, FLA.—Bonds to the amount of $310,000 have been voted for the installation of a municipal electric plant.

TAMPA, FLA. — The Tampa Electric Company plans extensions to its system, to cost about $900,000. Stone & Webster, Inc., 147 Milk Street, Boston, are engineers.

CHATTANOOGA, TENN.—The Tennessee Electric Power Company is planning to erect a transmission line from the Carter Street station to Valdeau, and also extensions to Daisy and Soddy, to cost about $120,000.

SPRINGFIELD, TENN.—The Davidson Light & Power Company has been granted permission to extend its transmission line to Orlinda and also to Handeyton and the Kentucky line. The company also has applied for permission to extend its service along the Louisville and Nashville pike to White House, Mitchellville, Cedar Hill, Browns Plains and other small communities.

VALDEAU, TENN.—The Tennessee Electric Power Company, Chattanooga, plans to erect a transmission line in this section, to cost about $125,000.

BIRMINGHAM, ALA. — The Alabama Power Company has applied for permission to extend its transmission lines from a point near Hapgood to the present distribution line serving Decatur, and also from Cherokee to connect with its lines at Russellville.

FLORENCE, ALA.—Bids will be received at the United States Engineer Office, Florence, until March 4, for switchboard, storage, battery, motor-generator sets, transformers, rotary converter, etc. For details see Searchlight Section.

UNION SPRINGS, ALA.—The Alabama Power Company has acquired a site about 2 miles from the city on which it will erect a substation. The company has also leased a building in the city which it proposes to remodel for a distributing station, storeroom and office building.

NEW ORLEANS, LA.—Extensions and improvements are contemplated by the New Orleans Public Service Company, including the installation of a 20,000-kw. electric generator, purchase of additional cars and improvements to gas system, to cost between $5,000,000 and $6,000,000.

SHREVEPORT, LA.—The installation of an ornamental lighting system on Travis and Louisiana Streets is planned.

CHILDRESS, TEX.—Extensive improvements are contemplated to the plant of the Childress Electric Light & Ice Company to enable it to supply electricity to several towns within a radius of 15 or 20 miles. A high-tension transmission line will be erected to Estelline, a distance of 20 miles.

DALLAS, TEX.—The Ford Motor Company, Detroit, will build a power house at its proposed assembling plant in the Eastern Heights section, to cost about $500,000. Albert Kahn, Marquette Building, Detroit, is architect.

EL PASO, TEX.—The cost of installing new lamps in the two lighting districts recently created by the City Council is estimated at about $110,000. The downtown district will cost $75,000 and Texas Street $35,000. W. E. Stockwell is engineer for the city plan commission.

HOUSTON, TEX. — The Lincoln Fig Growing Corporation, recently organized, plans to install a light and power system on tract of 100 acres of land about 14 miles from Houston, to be developed for farming and packing service. B. N. Garrett is president.

LOCKHART, TEX.—The Citizens' Light & Water Company contemplates extensions and improvements in its electric system.

SNYDER, TEX.—The electric plant of the Snyder Utilities Company was recently destroyed by fire, causing a loss of about $60,000. Plans, it is reported, are under way to rebuild the plant.

STAMFORD, TEX.—The West Utilities Company has acquired the plant of the Stamford Ice & Manufacturing, which it will remodel and equip with electrically operated machinery throughout. The cost is estimated at about $100,000.

TRENTON, TEX. — The local electric plant has been acquired by H. Brodhead, Whitewright. The new owner plans to erec, a high-tension line from Whitewright to Trenton.

Pacific and Mountain States

AMERICAN LAKE, WASH.—Bids will be received by the United States Veterans' Bureau, Room 791, Arlington Building, Washington, D. C., until Feb. 25 for the construction of a laundry building, including electric wiring, etc., at the United States Veterans' Hospital No. 94, American Lake, Wash.

AUBURN, WASH. — The Utah-Idaho Sugar Company, Salt Lake City, Utah, is reported to be planning to build a local mill and power plant, to cost about $1,000,000.

SEATLLE, WASH. — The Puget Sound Power & Light Company has applied for permission to construct a hydro-electric plant on the Baker River, to cost about $3,000,000.

TACOMA, WASH.—The City Council is considering the installation of an ornamental lighting system on South Yakima Avenue from Fifteenth to Twenty-seventh Streets.

VESTA, WASH. — The Grays Harbor Light & Power Company plans to erect a transmission line south to the county line.

ASTORIA, ORE.—Bids will be received by the city clerk until Feb. 4 for the installation of an ornamental lighting system.

KLAMATH FALLS, ORE.—The California-Oregon Power Company plans to erect a 66,000-volt transmission line to the Gold Ray section, to cost about $100,000.

BAKERSFIELD, CAL.—The City Clerk has been authorized to advertise for bids for the installation of an ornamental lighting system on Chester Avenue from Nineteenth to I Streets. W. D. Clarke is city engineer.

FRESNO, CAL.—The City Council is considering calling an election to submit to the voters the proposal to issue bonds for the installation of 250 firealarm boxes and extending the police telegraph and flashlight system. The cost is estimated at $25,000, T. A. Stranahan is city clerk.

MONTEREY, CAL.—The Coast Valley Gas & Electric Company plans to erect a transmission line from Calinas to Monterey and vicinity.

PASADENA, CAL.—Bonds to the amount of $250,000 have been voted for extensions and improvements in the municipal electric plant, including a new substation, transmission lines, etc.

RICHMOND, CAL.—The Pacific Gas & Electric Company has appropriated $70,000 for the installation of additional transformers, etc., at the local substation.

ROSEVILLE, CAL.—The Pacific Fruit Express Company, 65 Market Street, San Francisco, it is reported, is planning to build car shops including a power house in Roseville.

SAN FRANCISCO, CAL.—Bids will soon be asked by the Pacific Gas & Electric Company for the construction of a substation at Commercial and Liedesdorff Streets, to cost about $75,000.

SANTA MONICA, CAL.—The City Council has approved plans for the installation of an ornamental lighting system on Santa Monica Boulevard.

MIAMI, ARIZ. — Application has been made by the San Carlos Asbestos Corporation for the construction of a large hydro-electric plant at Big Peninsular Bend.

Canada

LETHBRIDGE, ALTA. — The city officials have decided to change the municipal electric lighting system from two-phase to three-phase. The cost is estimated at $17,000.

TABER, ALTA.—The installation of an electric light and power plant in Taber is under consideration.

KENORA, ONT. — An agreement, it is understood, has been reached between E. W. Backus, Minneapolis, Minn., owner of large pulp and paper developments in northwestern Ontario, and the Lake of Woods Control Board, in connection with a proposed power development to be undertaken by the former at the outlet of Lake of Woods. The reconstruction of the Norman Dam is included in the project.

LONDON, ONT.—Plans are being prepared by the Public Utilities Commission for three new substations.

SASKATOON, SASK.—The Council is considering changing the municipal electric system from two-phase to three-phase.

Electrical Patents

Announced by U. S. Patent Office

(January 8, 1924)

1,480,242. TELEPHONE-EXCHANGE SYSTEM; H. P. Clausen, Mount Vernon, and C. L. Goodrum, New York, N. Y. App. filed July 19, 1919. Operator's board in large offices, etc., for automatic system.

1,480,243. SIGNALING SYSTEM; A. A. Clokey, Rutherford, N. J. App. filed Nov. 5, 1921. Synchronizing system for operating secondary-clocks, time stamps, etc.

1,480,267. PROCESS FOR THE MANUFACTURE OF MANGANESE OR MANGANESE ALLOYS POOR IN CARBON AND SILICON; B. M. S. Kalling and S. D. Danieli, Trollhättan, Sweden. App. filed Feb. 1, 1922. Special reduction process carried on in electric furnace.

1,480,301. FURNACE; H. C. Rentschler, Pittsburgh, Pa. App. filed Dec. 13, 1920. Induction-type furnace for temperatures between 1,500 deg. C. and 3,000 deg. C.

1,480,312. METHOD OF MAKING STATORS; H. F. Stratton, Cleveland Heights, Ohio. App. filed July 26, 1922. To prevent cracking of casting upon cooling.

1,480,320. SPEED REGULATOR FOR HIGH-FREQUENCY MACHINES; G. G. von Arco, Berlin, Germany. App. filed Oct. 25, 1922. By two loosely coupled resonant circuits.

1,480,326. CONTROLLING APPARATUS FOR BATTERY-CHARGING MOTOR-GENERATOR SETS AND METHOD FOR STARTING OPERATION OF THE SAME; G. O. Wilms, Milwaukee, Wis. App. filed March 30, 1920.

1,480,328. SHORT-CIRCUITING MECHANISM; C. H. Wolff, St. Louis, Mo. App. filed Jan. 19, 1923. For single-phase repulsion motors.

1,480,353. ELECTRODE; R. H. Wappler, Yonkers, N. Y. App. filed Jan. 19, 1921. For medical and therapeutical use.

1,480,362. PORTABLE ELECTRIC HEATER; O. N. Anderson, Minneapolis, Minn. App. filed Oct. 3, 1922. Reflector type.

1,480,388. OSCILLATOR; A. L. Golden, Oakland, Cal. App. filed Sept. 16, 1919. High-frequency oscillator for radio telephone, telegraph, etc.

1,480,403. TELEPHONE-EXCHANGE SYSTEM; J. W. Lattig, Bethlehem, Pa. App. filed March 16, 1922. Coin collecting and metering systems for automatic telephone exchanges.

1,480,412. DYNAMO-ELECTRIC MACHINERY; C. A. Parsons and J. Rosen, Newcastle-on-Tyne, England. App. filed April 30, 1923. Method of bracing end coils.

1,480,445. TOY ELECTRIC STEAM ENGINE; S. D. Horlacher and W. E. Horlacher, Tunkhannock, Pa. App. filed March 13, 1922.

1,480,454. RADIO TUNING COIL; J. L. McLaughlin, New York, N. Y. App. filed June 29, 1922. Single-coil tuner.

1,480,515. ELECTRICAL INSTANTANEOUS WATER HEATER WITH CONTINUOUS CIRCULATION, WORKING AT DIFFERENT VOLTAGES; A. De Marchis (deceased), by E. Caselli, Rome, Italy. App. filed Feb. 18, 1921.

1,480,523. DEVICE FOR LOCKING ELECTRIC INCANDESCENT LAMPS IN THEIR LAMP-HOLDERS; H. Francis, Shepherds Bush, England. App. filed Nov. 15, 1921.

1,480,533. DEPOLARIZING MIXTURE AND METHOD OF PREPARING SAME; W. R. Clymer, Cleveland, Ohio. App. filed Sept. 17, 1920. For dry cells of the Le Clanché type.

1,480,534. VARIOCOUPLER; A. Crossley, Washington, D. C. App. filed Aug. 16, 1922. Spider-web winding for rotor.

(Issued Jan. 15, 1924)

1,480,553. PHONOGRAPH MOTOR; E. B. Hoff, Cleveland, Ohio. App. filed July 3, 1922. Operating table forms rotor of motor.

1,480,573. APPARATUS FOR TREATING GRAIN, BEANS, ETC., BY DISRUPTIVE CONDUCTION; F. S. Smith, Philadelphia, Pa. App. filed March 27, 1919.

1,480,587. ELECTRIC WIRING SYSTEM; R. C. Wilson, New York, and H. S. Arnold, Brooklyn, N. Y. App. filed June 10, 1922. Duct system for walls and ceilings.

1,480,599. FLOOR LAMP; J. R. Cravath and A. M. Cravath, Berkeley, Cal. App. filed March 11, 1921. Combined direct and indirect lighting unit.

1,480,612. MULTIPLEX SIGNALING SYSTEM; H. W. Hitchcock, New York, N. Y. App. filed Nov. 12, 1921. Telephone circuits upon which carrier channels may be superposed.

1,480,614. TELEPHONE REPEATER; O. B. Jacobs, Morris Plains, N. J. App. filed Oct. 18, 1919. Repeaters of cord circuit type.

1,480,615. CONTROL SYSTEM FOR MACHINE TOOLS; S. P. Johnson, Philadelphia, Pa. App. filed Feb. 2, 1921.

1,480,618. CONTROLLER FOR ELECTRICAL SYSTEMS; L. S. Keilholtz, Dayton, Ohio. App. filed May 26, 1919. Battery generator and ignition system for automobiles.

1,480,626. ELECTRIC FURNACE SIGNAL; W. W. Miron, Oakland, Cal. App. filed July 3, 1919. For indicating when electrode touches metal or furnace wall.

1,480,645. RESISTANCE DEVICE; A. E. Waller, Bronxville, N. Y. App. filed March 27, 1922. Method of fastening heating element resistors.

1,480,656. ELECTRICAL CONNECTION FOR AUTOMOBILES; J. Blackburn, Webster Groves, Mo. App. filed Nov. 8, 1919. Method of running wires through steering column.

1,480,659. SIGNALING SYSTEM; Q. A. Brackett, Pittsburgh, Pa. App. filed Dec. 7, 1920. Radiation of energy from arc systems.

1,480,665. PHASE-CONVERTING SYSTEM; L. W. Chubb, Pittsburgh, Pa. App. filed March 13, 1918. Method of power-factor control.

1,480,666. BALANCED PHASE CONVERTING SYSTEM; L. W. Chubb, Edgewood Park, Pa. App. filed Dec. 13, 1917. Reactive and ohmic drops within converter compensated.

1,480,667. ELECTRIC HEATER; O. A. Colby Irwin, Pa. App. filed Sept. 2, 1922. Air heater.

1,480,670. PHASE CONVERTING AND POWER-FACTOR-CONTROL MACHINE; S. H. Cowin, Edgewood Park, Pa. App. filed Oct. 17, 1918. Synchronous condenser for power-factor control on same shaft as phase converter.

1,480,675. ELECTRIC RESISTOR AND ITS PROCESS OF MANUFACTURE; J. F. Dirzuweit, Laurel, Md. App. filed Nov. 11, 1920. Element for electric melting and heating furnaces.

1,480,696. MAGNETO CONTACT; P. A. Schaefer, Greensburg, Pa. App. filed March 1, 1922.

1,480,708. BALANCED-PHASE CONVERTING SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Dec. 13, 1917. Polyphase circuits automatically balanced.

1,480,709. BALANCED-PHASE CONVERTING SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 16, 1918. Self-balancing type.

1,480,710. BALANCING SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 17, 1918. Prevention of harmonics in phase-converting system.

1,480,711. PHASE-CONVERTING SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 16, 1918. Balanced type.

1,480,712. PHASE CONVERTER FOR SINGLE-PHASE CURRENTS; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 5, 1921. Method of balancing single-phase loads taken from three-phase source.

1,480,713. PHASE-CONVERTER SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Nov. 16, 1918. Compensating impedance electromotive forces of converter.

1,480,714. SYSTEM OF DISTRIBUTION; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 1, 1921. Constant-current transformer for arc-welding machine.

1,480,715. PHASE-CONVERTER SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed April 27, 1922. Phase-conversion apparatus.

1,480,716. PHASE-BALANCING SYSTEM; C. Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 24, 1922. For supplying unbalanced single-phase loads from three-phase system.

1,480,720. SHORT-CIRCUITING DEVICE; G. H. Garcelon, Swissvale, Pa. App. filed Aug. 12, 1922. For repulsion-type motor.

1,480,722. MEANS FOR AND METHOD OF ELIMINATING HARMONIC DISTURBANCES; R. E. Hellmund, Swissvale, Pa. App. filed Dec. 14, 1918. Absorbs harmonics in circuits of rectifiers.

1,480,723. ABSORPTION OF CURRENTS OF UNDESIRABLE FREQUENCIES; R. E. Hellmund, Swissvale, Pa. App. filed Dec. 14, 1918. Absorbs harmonics produced in line.

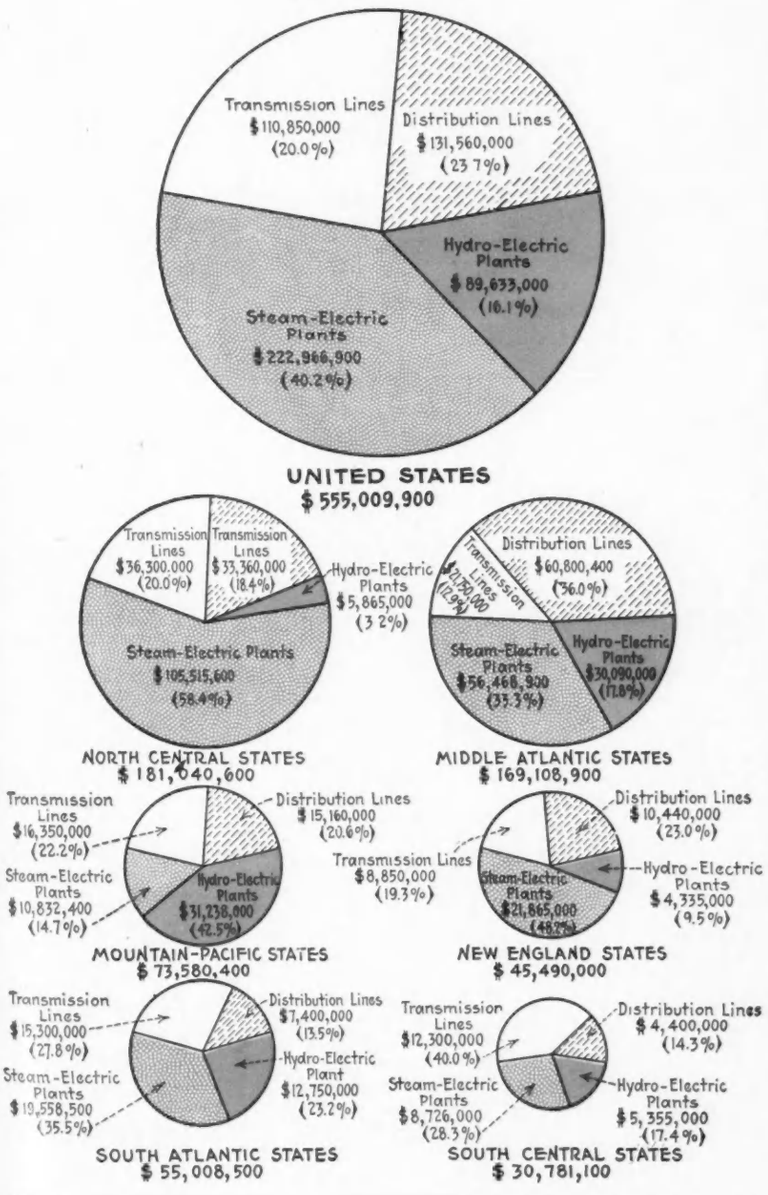
1,480,726. STORAGE BATTERY; L. Jacquemin, Orlando, Fla. App. filed July 2, 1923. Terminal construction for automobile batteries.

1,480,734. ACTUATING DEVICE; K. O. Nelson, Mineola, L. I., N. Y. App. filed Oct 28, 1920. Electromagnetic recording device.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Probable Central Station Extensions During 1924 Will Reach a Value of $555,000,000



Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

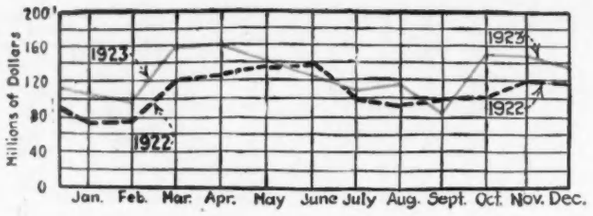
Large Extensions Planned for 1924

IT HAS been truly stated that "We may analyze the past—it is the future which is vital." The year 1923 was in every way a record one for the electric light and power industry. Financing, output and gross revenue materially surpassed the prognostications made at the opening of the year. But a new year of activity has opened, and what advance will be made during the coming twelve months is the really vital question now before the industry.

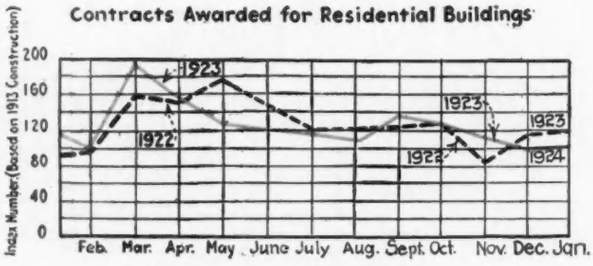
The composite opinion of the industry is that during 1924 the amount of energy generated by the central stations will exceed 1923 by 14.2 per cent and that the revenue from sale of energy will show an increase of 13 per cent. This increased consumption of energy will call for extensive increases in generating capacity and large extensions to the transmission and distribution systems of the country. Generator rating should be increased by 2,900,000 kva., and the length of the transmission and distribution lines should be increased by 7,390 and 32,890 circuit miles respectively. The value of these extensions is conservatively estimated at $555,000,000.

Electric light and power securities have attained to such a high plane as sound investments that the industry should be able to finance these extensions at a yield under 6½ per cent, and the stronger companies will without doubt be able to borrow at a rate under 6 per cent. The money market and electric light and power securities have materially changed their positions for the better since the summer of 1921, when many companies were forced to borrow at more than 8 per cent and even the strongest paid over 7 per cent.

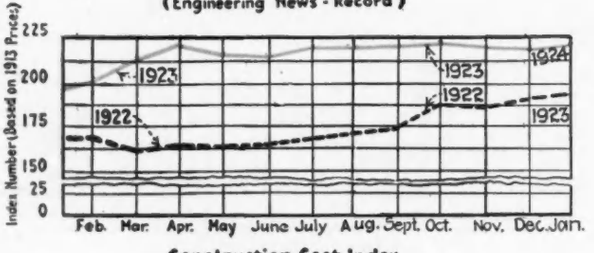
How the Primary Industries Are Trending



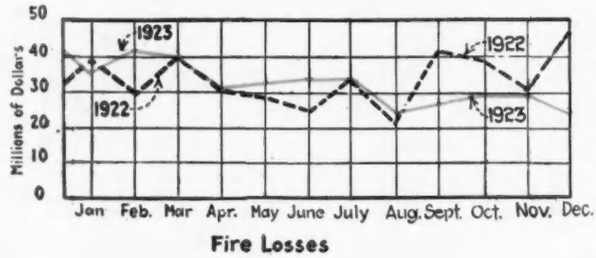
Contracts Awarded for Residential Buildings



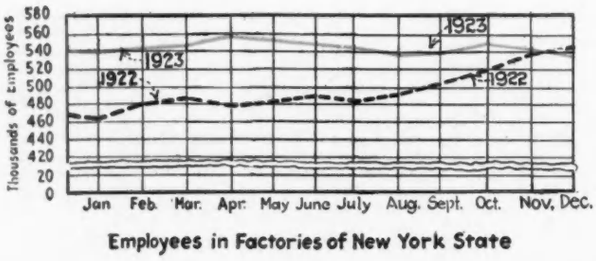
Construction Volume Index
(Engineering News-Record)



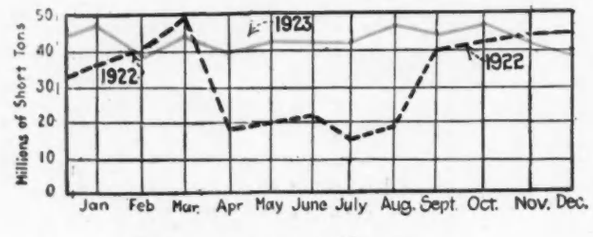
Construction Cost Index
(Engineering News-Record)



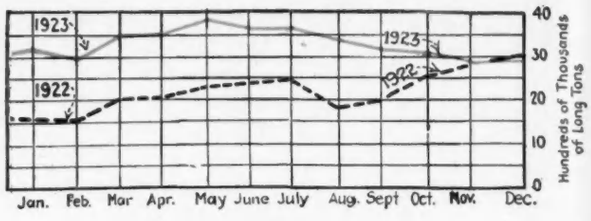
Fire Losses



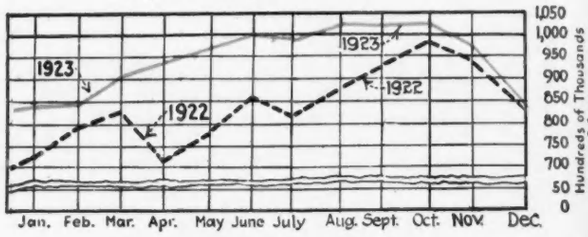
Employees in Factories of New York State



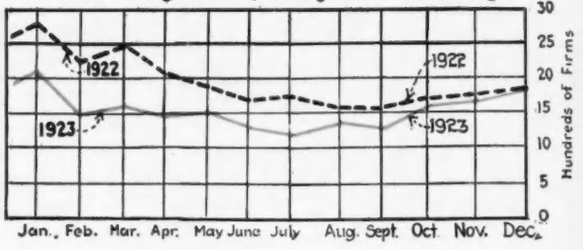
Bituminous Coal Production



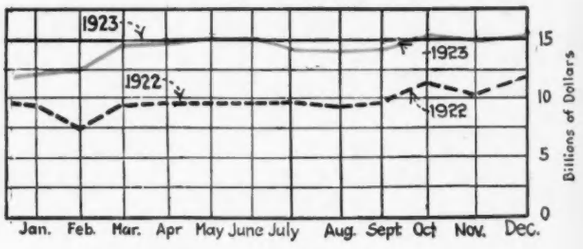
Pig-Iron Production



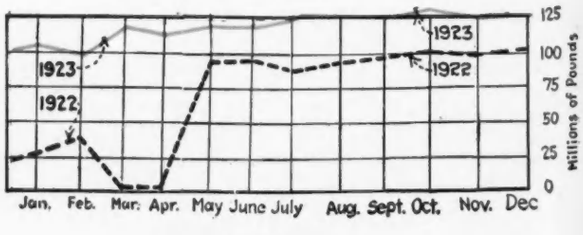
Total Average Weekly Freight-Car Loadings



Business Failures



Bank Clearings
Outside of New York City)



Copper Production

Economic Outlook for 1924 Bright

THE economic prospects of 1924 are summed up as follows by Secretary Herbert Hoover: "The economic outlook for our own country for the next year is bright. In general the world situation is hopeful. The general spirit of prudence, the absence of speculation, complete employment, high production and the great financial strength and stability of the important states in the Western Hemisphere, together with the promise of the early conference for systematic consideration of a constructive solution of the world's greatest economic menace—Franco-German relations—all create a hopeful foundation on which the New Year may build."